

# California Science Test



## High School Practice Test Constructed Response Annotated Examples

This guide provides scored and annotated student examples for selected constructed response items and is intended to be used in conjunction with the California Science Test (CAST) Practice Test Scoring Guide.



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This packet provides the prompts, rubrics, and scored and annotated student examples for two constructed-response items on the high school practice test, and is intended to be used in conjunction with the high school [CAST: Practice Test Scoring Guides](#). The Scoring Guide includes a glossary of terms, student response types, correct responses, and related scoring considerations for the practice test items.

## CAST Practice Test Item 38 Metadata

This item is part of a performance task. Refer to the online Practice Test and the Scoring Guide for additional context.

**Table 1. Metadata**

Item	PE	SEP	DCI	CCC	ILCS
38	HS-LS3-2	7. Engaging in Argument from Evidence	LS3.B Variation of Traits	2. Cause and Effect	Explain that genetic variation depends on both environmental and genetic factors in this rabbit species.

## CAST Practice Test Item 38 Prompt

*Based on the information in the tables, explain how **both** genetic and environmental factors can affect point color variation in Californian rabbits.*

*Enter your answer in the box provided.*

## Constructed Response Rubric and Student Samples

### Score Point

**2**

### High School Score Point 2 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
<p>The response includes that genetic factors affect point color variation because the specific phenotype expressed (black or gray) depends partly on the alleles that are inherited.</p> <p>AND</p> <p>The response includes that environmental factors can affect point color variation because the temperature that the rabbit is exposed to will influence the expression of its inherited alleles, thus altering its phenotype.</p>	<p><i>Genetic factors can affect point color variation because the color shown depends on the alleles that are inherited. Environmental factors can affect point color variation because it depends on the temperature that the rabbit is exposed to because temperature influences the expression of its inherited alleles, changing the point color.</i></p>

### High School Sample 1, Score Point 2

Student Response	Score Rationale and Evidence
<p><i>The rabbits have the ability to present different colors due to the colors of their parents. The rabbits are able to change color based on temp if they have a dominate gene from the parent to use that ability. If they have recessive genes for environmental color change, then they will not change color.</i></p>	<p>The response correctly explains how genetic factors affect point color variation (<i>The rabbits are able to change color based on temperature if they have a dominate gene from their parents... If they have recessive genes for environmental color change, then they will not change color.</i>). The response correctly explains how environmental factors affect point color variation (<i>The rabbits are able to change color based on temp...</i>).</p>

### High School Sample 2, Score Point 2

Student Response	
<p><i>Californian Rabbits color variation can be changed due to temperature. This is due to the dense-dilute gene that they inherited. Also genetics made the one albino rabbit because there's always a chance to get another color variation through genes.</i></p>	<p>The response correctly explains how genetic factors affect point color variation (<i>This [point color change] is due to the dense-dilute gene that they inherited. Also genetics made the one albino rabbit because there's always a chance to get another color variation through genes.</i>). The response also correctly explains how environmental factors affect point color variation (<i>Californian Rabbits color variation can be changed due to temperature.</i>).</p>

### High School Sample 3, Score Point 2

Student Response	Score Rationale and Evidence
<p><i>The genetic factors determined the alleles inherited and phenotypes associated with the rabbits and the environmental factors affected the expressed phenotype. The phenotype expressed was dependent on the environment's temperature.</i></p>	<p>The response correctly explains how genetic factors affect point color variation (<i>The genetic factors determined the alleles inherited and phenotypes associated with the rabbits ...</i>). The response also correctly explains how environmental factors affect point color variation (<i>The phenotype expressed was dependent on the environment's temperature.</i>).</p>

## Score Point

# 1

### High School Score Point 1 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
<p>The response includes that genetic factors affect point color variation because the specific phenotype expressed (black or gray) depends partly on the alleles that are inherited.</p> <p>OR</p> <p>The response includes that environmental factors can affect point color variation because the temperature that the rabbit is exposed to will influence the expression of its inherited alleles, altering its phenotype.</p>	<p><i>Genes can affect the color that is expressed because it depends partly on what alleles are inherited.</i></p> <p>OR</p> <p><i>The environment affects the color of the rabbit because the temperature that the rabbit lives in can make the color change.</i></p> <p>OR</p> <p><i>The temperature change caused the rabbits points to change color.</i></p> <p>OR</p> <p><i>It's in the traits because of the alleles that are inherited from the parents.</i></p>

### High School Sample 4, Score Point 1

Student Response	Score Rationale and Evidence
<p><i>Environmental factors affect point color variation in California rabbits by certain temperatures like 20°C makes the gray point rabbits turn to black points. Genetic factors can impact a rabbit's color by the rabbits could have a missing or extra allele for example.</i></p>	<p>The response correctly explains how environmental factors affect point color variation (<i>Environmental factors affect point color variation in California rabbits by certain temperatures like 20°C makes the gray point rabbits turn to black points.</i>). The response explanation of how genetic factors affect point color variation is incorrect and not based on the information in the tables.</p>

### High School Sample 5, Score Point 1

Student Response	Score Rationale and Evidence
<p><i>Environmental factors (in this case the temperature) elicit a reaction that has been built into the genes of the Californian rabbits, which is the black points turning grey at different temperatures. Genetic factors determine the base point color when it is not 30°C or higher.</i></p>	<p>The response correctly explains how environmental factors affect point color variation (<i>Environmental factors [in this case the temperature] elicit a reaction ... which is the black points turning grey at different temperatures.</i>). The response does not earn credit for a vague explanation of how genetic factors affect point color variation (<i>Genetic factors determine the base point color when it is not 30°C or higher.</i>).</p>



### High School Sample 6, Score Point 1

Student Response	Score Rationale and Evidence
<p><i>Both genetic and environmental factors can affect point color variation due to environmental changes and things such that have to do w/genotypes. Over time there was an effect on rabbits due to temperature change when their color changed after the temperature changed. We also read about change when another group of kits were born and one was albino.</i></p>	<p>The response does not earn credit for a vague explanation of how genetic factors affect point color variation (<i>Both genetic and environmental factors can affect point color variation due to environmental changes and things such that have to do w/genotypes.</i>). The response correctly explains how environmental factors affect point color variation (<i>... there was an effect on rabbits due to temperature change when their color changed after the temperature changed.</i>).</p>

Score Point

0

High School Score Point 0 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
0-point should be awarded if a student attempts to answer the prompt but the response is incorrect or too vague (insufficient information provided) to receive credit.	<p><i>The rabbit's genes affect point color variation more than the environment.</i></p> <p>OR</p> <p><i>The rabbit's genes and the environment both effect the point color in the rabbits.</i></p> <p>OR</p> <p><i>It has to be the genes because how can temperature make a rabbit change its color.</i></p> <p>OR</p> <p><i>*&amp;YTT%\$#\$D</i></p> <p>OR</p> <p><i>I don't know; I was never taught this.</i></p>

### High School Sample 7, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>Both genetic and environmental factors can affect point color variation in Californian rabbits because the rabbits have different alleles and genetic combinations. Which creates how they react differently to the environment.</i></p>	<p>The response does not earn credit for the incomplete explanation of how genetic factors affect point color variation (... <i>the rabbits have different alleles and genetic combinations.</i>). The response does not earn credit for the incomplete explanation of environmental factors that does not include temperature as the environmental factor that affects point color (... <i>environmental factors can affect point color variation ...</i>).</p>

### High School Sample 8, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>Genetic environment can affect the color variations because the rabbits adapt to their environment to live and the temperature. If its all snow the rabbits going to be white. If its hot that means things are going to be brown which means the rabbits going to be brown.</i></p>	<p>The response does not earn credit for a vague explanation of how genetic factors affect point color variation that is essentially a repeat of the prompt (<i>Genetic environment can affect the color variations ...</i>). The response does not earn credit for an explanation of how environmental factors affect point color variation that is not based on the information in the tables (<i>If its all snow the rabbits going to be white. If its hot that means things are going to be brown which means the rabbits going to be brown.</i>).</p>

## High School Sample 9, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>The sequence of DNA may not be affected by your environment, the way genes work – called gene expression. Environmental factors such as food or exposure of toxins can cause changes by altering the way molecules bind to DNA.</i></p>	<p>The response does not provide the required element of explaining how genetic factors affect point color variation. The response does not earn credit for an explanation of how environmental factors affect point color variation that is not based on the information in the tables (<i>Environmental factors such as food or exposure of toxins can cause changes by altering the way molecules bind to DNA.</i>).</p>

## CAST Practice Test Item 44 Metadata

This item is part of a performance task. Refer to the online Practice Test and the Scoring Guide for additional context.

**Table 1. Metadata**

Item	PE	SEP	DCI	CCC	ILCS
44	HS-PS1-6	6. Constructing Explanations and Designing Solutions	PS1.B Chemical Reactions	7. Stability and Change	Identify or describe the scientific principles that support the effectiveness of the change to meet the criteria to maintain equilibrium.

## CAST Practice Test Item 44 Prompt

*Using Le Chatelier's principle, explain how an increase in pressure in the system at a constant temperature and volume would also disrupt the equilibrium **and** increase the amount of  $\text{NH}_3$  when equilibrium is restored.*

*Enter your answer in the box provided.*

## Constructed Response Rubric and Student Samples

### Score Point

# 2

### High School Score Point 2 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
<p>The response includes that an increase in pressure would increase the frequency of collisions between the reactant molecules.</p> <p>AND</p> <p>The response indicates that a system at equilibrium will adjust the effects of any change, so the equilibrium will shift to the right to produce more ammonia or <math>\text{NH}_3</math> to reduce the overall pressure of the system.</p>	<p><i>An increase in pressure would increase how often molecules collide. The reaction will reduce the effect of this by shifting the equilibrium to the right to make more <math>\text{NH}_3</math> because there are fewer molecules on the right side of the equation.</i></p>

### High School Sample 1, Score Point 2

Student Response	Score Rationale and Evidence
<p><i>More pressure would increase the amount of reactions that occur by causing more collisions. More collisions with the reactants will cause more products to be produced as the system pushes for these reactants to become more products to restore equilibrium and make less pressure.</i></p>	<p>The response correctly explains that an increase in pressure will result in an increase in the frequency of collisions (<i>More pressure would increase the amount of reactions that occur by causing more collisions.</i>). The response also correctly explains that an increase in pressure will disrupt equilibrium and increase <math>\text{NH}_3</math> (<i>More collisions with the reactants will cause more products to be produced as the system pushes for these reactants to become more products to restore equilibrium and make less pressure.</i>).</p>

### High School Sample 2, Score Point 2

Student Response	Score Rationale and Evidence
<p><i>Increasing the pressure will increase the number of collisions. The formation of additional amount of ammonia reduces the total pressure caused by the system and somewhat reduces the strength of the increased pressure.</i></p>	<p>The response correctly explains that an increase in pressure will result in an increase in the frequency of collisions (<i>Increasing the pressure will increase the number of collisions.</i>). The response also correctly explains how an increase in pressure disrupts equilibrium and increases <math>\text{NH}_3</math> (<i>.The formation of additional amount of ammonia reduces the total pressure caused by the system ...</i>).</p>

### High School Sample 3, Score Point 2

Student Response	Score Rationale and Evidence
<p><i>Increasing pressure will cause more collisions resulting in more reactions changing the state of equilibrium. More reactions equals more product and less pressure.</i></p>	<p>The response correctly explains that an increase in pressure will result in an increase in the frequency of collisions (<i>Increasing pressure will cause more collisions . . .</i>). The response also correctly explains how an increase in pressure disrupts equilibrium and increases <math>\text{NH}_3</math> (<i>More reactions equals more product and less pressure.</i>).</p>



## Score Point

# 1

### High School Score Point 1 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
<p>The response indicates that an increase in pressure would increase the frequency of collisions between the reactant molecules.</p> <p>OR</p> <p>The response indicates that a system at equilibrium will adjust to reduce the effects of any changes, so the equilibrium will shift to the right to produce more ammonia or <math>\text{NH}_3</math> to reduce the overall pressure of the system.</p>	<p><i>An increase in pressure would increase the number of collisions between molecules.</i></p> <p>OR</p> <p><i>The reaction will adjust to reduce the effects of the increase in pressure by shifting the equilibrium to the right and to produce more <math>\text{NH}_3</math>. The equilibrium will shift to the right producing more ammonia.</i></p>

### High School Sample 4, Score Point 1

Student Response	Score Rationale and Evidence
<i>Adding pressure to the system would be a stress in this case. This would cause more <math>\text{NH}_3</math> to be produced to make less pressure after equilibrium has been restored.</i>	The response does not include the required explanation of the relationship between increasing the pressure and the number of collisions. The response correctly explains that an increase in pressure will cause the equilibrium to shift to the right ( <i>Adding pressure to the system would be a stress in this case. This would cause more <math>\text{NH}_3</math> to be produced to make less pressure after equilibrium has been restored.</i> ).

### High School Sample 5, Score Point 1

Student Response	Score Rationale and Evidence
<i>An increase in pressure disrupts the equilibrium because it would make the chemical reaction unequal. This would favor the product side more than the reactant side so there would be less pressure.</i>	The response does not include the required explanation of the relationship between increasing the pressure and the number of collisions. The response correctly explains how an increase in pressure disrupts equilibrium ( <i>This [increase in pressure] would favor the product side more than the reactant side so there would be less pressure.</i> ). Favoring the product side is equivalent to shifting to the right or producing more ammonia.

### High School Sample 6, Score Point 1

Student Response	Score Rationale and Evidence
<p><i>An increase in pressure will make the molecules have more collisions and shift the reaction one way. Since there has to be an equilibrium the reaction shifts.</i></p>	<p>The response correctly explains the relationship between increasing the pressure and the number of collisions (<i>An increase in pressure will make the molecules have more collisions ...</i>). The response is not credited for a vague description of equilibrium shifting that does not explain the direction of the shift (<i>... shift the reaction one way.</i>).</p>

## Score Point

# 0

### High School Score Point 0 Rubric and Exemplars from Scoring Guide

Rubric	Exemplar(s)
0-point should be awarded if a student attempts to answer the prompt but the response is incorrect or too vague (insufficient information provided) to receive credit.	<p><i>The percent yield of ammonia at equilibrium would not be affected by an increase in pressure.</i></p> <p>OR</p> <p><i>There will be more ammonia.</i></p> <p>OR</p> <p><i>An increase in pressure would decrease the number of collisions between molecules.</i></p> <p>OR</p> <p><i>The equilibrium will shift to the left, producing less ammonia/NH<sub>3</sub>.</i></p> <p>OR</p> <p><i>*&amp;YTT%#\$D</i></p> <p>OR</p> <p><i>I don't know; I was never taught this.</i></p>

### High School Sample 7, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>If the pressure increases, then the equilibrium shifts to the side with the fewer number. Reactions proceed in both directions. Reactants go to products and products go to reactants. A chemical system at equilibrium can be temporarily shifted out of equilibrium by adding or removing one or more of the reactants or products.</i></p>	<p>The response does not include the required explanation of the relationship between increasing the pressure and the number of collisions. The response is not credited for a vague explanation of how an increase in pressure disrupts equilibrium that does not indicate the direction of the shift (<i>If the pressure increases, then the equilibrium shifts to the side with the fewer number.</i>). It is unclear from the response which side of the equation the student considers to be the side with the fewer number.</p>

### High School Sample 8, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>Due to one thing being disrupted in the equation, the entire chemical reaction was changed. By increasing the pressure, stress is introduced in the chemical equation. This shift decreases the amount of molecules. The chemical reaction will shift toward the side that contains more molecules.</i></p>	<p>The response does not include the required explanation of the relationship between increasing the pressure and the number of collisions. The response is not credited for an incorrect explanation of how an increase in pressure disrupts equilibrium and increases <math>\text{NH}_3</math> (<i>By increasing the pressure, stress is introduced in the chemical equation. This shift decreases the amount of molecules. The chemical reaction will shift toward the side that contains more molecules.</i>). A shift toward the side that contains more molecules is incorrect.</p>

### High School Sample 9, Score Point 0

Student Response	Score Rationale and Evidence
<p><i>It would cause an imbalance but once it evens out the entire reaction will continue and produce extra NH<sub>3</sub> to cause an equilibrium.</i></p>	<p>The response does not include the required explanation of the relationship between increasing the pressure and the number of collisions. The response is not credited for an incomplete explanation of how an increase in pressure disrupts equilibrium (<i>It would cause an imbalance but once it evens out the entire reaction will continue and produce extra NH<sub>3</sub> to cause an equilibrium.</i>). The response is essentially a repeat of the prompt.</p>