



MASSACHUSETTS

Department of Elementary
and Secondary Education

*Release of Spring 2026
MCAS Test Items
from the
High School Biology
Paper-Based Test*

Spring 2026

**Massachusetts Department of
Elementary and Secondary Education**



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and Secondary Education

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Overview of High School Biology Test

The spring 2026 high school Biology test was administered in two formats: a computer-based version and a paper-based version. Most students took the computer-based test. The paper-based test was offered as an accommodation for eligible students who were unable to use a computer. More information can be found on the MCAS Test Administration Resources page at www.doe.mass.edu/mcas/admin.html.

Most of the operational items on the high school Biology test were the same, regardless of whether a student took the computer-based version or the paper-based version. In places where a technology-enhanced item was used on the computer-based test, an adapted version of the item was created for use on the paper test. These adapted paper items were multiple-choice or multiple-select items that tested the same Science content and assessed the same standard as the technology-enhanced item.

This document displays released items from the paper-based test. Released items from the computer-based test are available on the MCAS Resource Center website at mcas.onlinehelp.cognia.org/released-items.

Test Sessions and Content Overview

The high school Biology test was made up of two separate test sessions. Each session included selected-response questions and constructed-response questions. On the paper-based test, the selected-response questions were multiple-choice items and multiple-select items, in which students select the correct answer(s) from among several answer options.

Standards and Reporting Categories

The high school Biology test was based on learning standards in the 2016 *Massachusetts Science and Technology/Engineering Curriculum Framework*. The Framework is available on the Department website at www.doe.mass.edu/frameworks/current.html.

The biology standards are grouped under the four content reporting categories listed below.

- Molecules to Organisms
- Heredity
- Evolution
- Ecosystems

Most items on the high school Biology test are also reported as aligning to one of three MCAS Science Practice Categories. The three practice categories are listed below.

- Practice Category A: Investigations and Questioning
- Practice Category B: Mathematics and Data
- Practice Category C: Evidence, Reasoning, and Modeling

More information about the practice categories is available on the Department website at www.doe.mass.edu/mcas/tdd/practice-categories.html.

The table at the conclusion of this document provides the following information about each released operational item: reporting category, standard covered, science practice category covered (if any), item type, and item description. The correct answers for released selected-response questions are also displayed in the table.

Reference Materials

Each student taking the paper-based version of the high school Biology test was provided with a calculator.

During both high school Biology test sessions, the use of authorized bilingual word-to-word dictionaries and glossaries was allowed for students who are currently or were ever reported as English learners. No other reference tools or materials were allowed.

High School Biology

SESSION 1

This session contains 20 questions.

Directions

Read each question carefully and then answer it as well as you can. You must record all answers in this Test & Answer Booklet.

For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

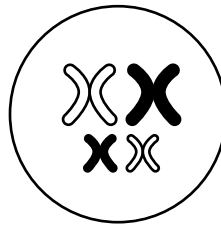
- 1 A gardener had two types of hydrangea plants, hydrangea X and hydrangea Y. The gardener planted some of each type of hydrangea in three types of soil: acidic, neutral, and alkaline. The gardener recorded the color of the flowers produced by each plant. The data are shown in the table.

Plant Type	Acidic Soil	Neutral Soil	Alkaline Soil
hydrangea X	white	white	white
hydrangea Y	blue	purple	pink

Which of the following conclusions is best supported by the gardener's data?

- Ⓐ The flower colors of both hydrangea X and hydrangea Y are most likely a result of genetics.
- Ⓑ The flower colors of both hydrangea X and hydrangea Y are most likely a result of the environment.
- Ⓒ The flower color of hydrangea X is most likely the result of the environment, and the flower color of hydrangea Y is most likely a result of genetics.
- Ⓓ The flower color of hydrangea X is most likely the result of genetics, and the flower color of hydrangea Y is most likely a result of the environment.

- 2 The diagram represents a cell at the beginning of meiosis.



Which of the following shows the final products of meiosis for this cell?

- (A)
- (B)
- (C)
- (D)

3 The steps of an investigation to determine the rate of cellular respiration in cells are shown. Some changes should be made to the investigation.

1. Place yeast cells, which are a type of fungus, in a solution that is high in carbohydrates.
2. Add carbon dioxide gas to the solution with the cells.
3. Place the solution with the cells in an area without light.
4. Measure the rate of oxygen produced by the cells.

Select **two** changes that should be made to the investigation to better determine the rate of cellular respiration in cells.

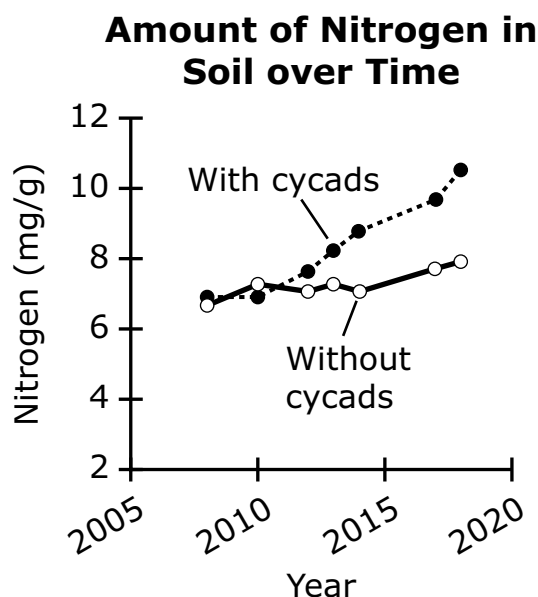
- Ⓐ Use a different type of cell because yeast cells do not carry out cellular respiration.
- Ⓑ Use a solution that is high in proteins instead of carbohydrates because proteins are required for cellular respiration.
- Ⓒ Add oxygen gas to the solution instead of carbon dioxide gas because the cells require oxygen to carry out cellular respiration.
- Ⓓ Place the solution with the cells in an area with light because light is required for the cells to carry out cellular respiration.
- Ⓔ Measure the rate of carbon dioxide produced by the cells instead of oxygen because carbon dioxide is a product of cellular respiration.

- 4 Sodium ion levels in the blood are controlled by a feedback loop. When sodium ion levels in the blood drop too low, the hormone aldosterone is released from the adrenal glands. Aldosterone causes the kidneys to reabsorb more sodium ions. This returns more sodium ions to the blood.

Which of the following will **most likely** occur when sodium ion levels in the blood return to normal?

- Ⓐ The aldosterone will begin to act on nerve cells.
- Ⓑ The adrenal glands will stop releasing aldosterone.
- Ⓒ The kidneys will reabsorb sodium ions at a faster rate.
- Ⓓ The kidneys will signal the liver to filter sodium ions from the blood.

- 5 Scientists studied how cycad trees affect the amount of nitrogen in soil over time. They compared the amount of nitrogen in an area with cycad trees to the amount of nitrogen in an area without cycad trees. The graph shows the scientists' results.



One scientist claims that plants in the area with cycad trees should grow larger than plants in the area with no cycad trees.

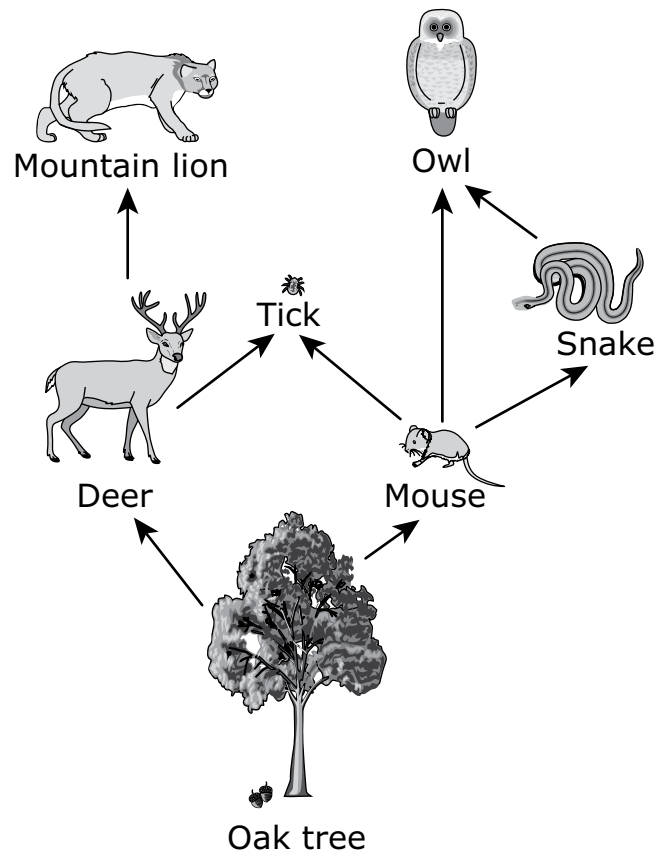
The scientist's claim is

- Ⓐ supported by the graph.
- Ⓑ not supported by the graph.

Which of the following describes the area with cycad trees?

- Ⓐ There is more nitrogen available for plants to make waxy lipids.
- Ⓑ There is more nitrogen available for plants to make structural proteins.
- Ⓒ There is less nitrogen available for plants to make simple carbohydrates.
- Ⓓ There is less nitrogen available for plants to make structural proteins.

- 6 A partial food web is shown.



Which of the following organisms is classified as a primary consumer?

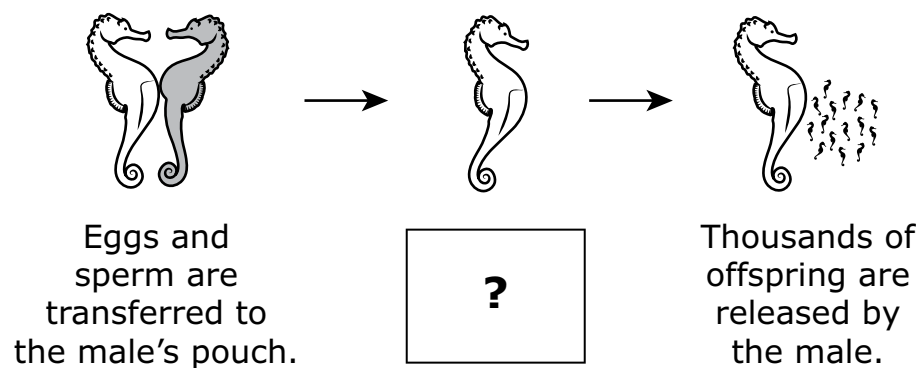
- Ⓐ deer
- Ⓑ mountain lion
- Ⓒ oak tree
- Ⓓ tick

7 Which of the following processes moves carbon from organisms to the nonliving environment?

- Ⓐ condensation
- Ⓑ decomposition
- Ⓒ evaporation
- Ⓓ transpiration

8 Male seahorses carry offspring in their reproductive pouches. An incomplete model of seahorse reproduction is shown.

Seahorse Reproduction



Which of the following best completes the model?

Ⓐ Crossing over occurs and offspring develop.

Ⓑ Gametes divide and offspring develop.

Ⓒ Fertilization occurs and offspring develop.

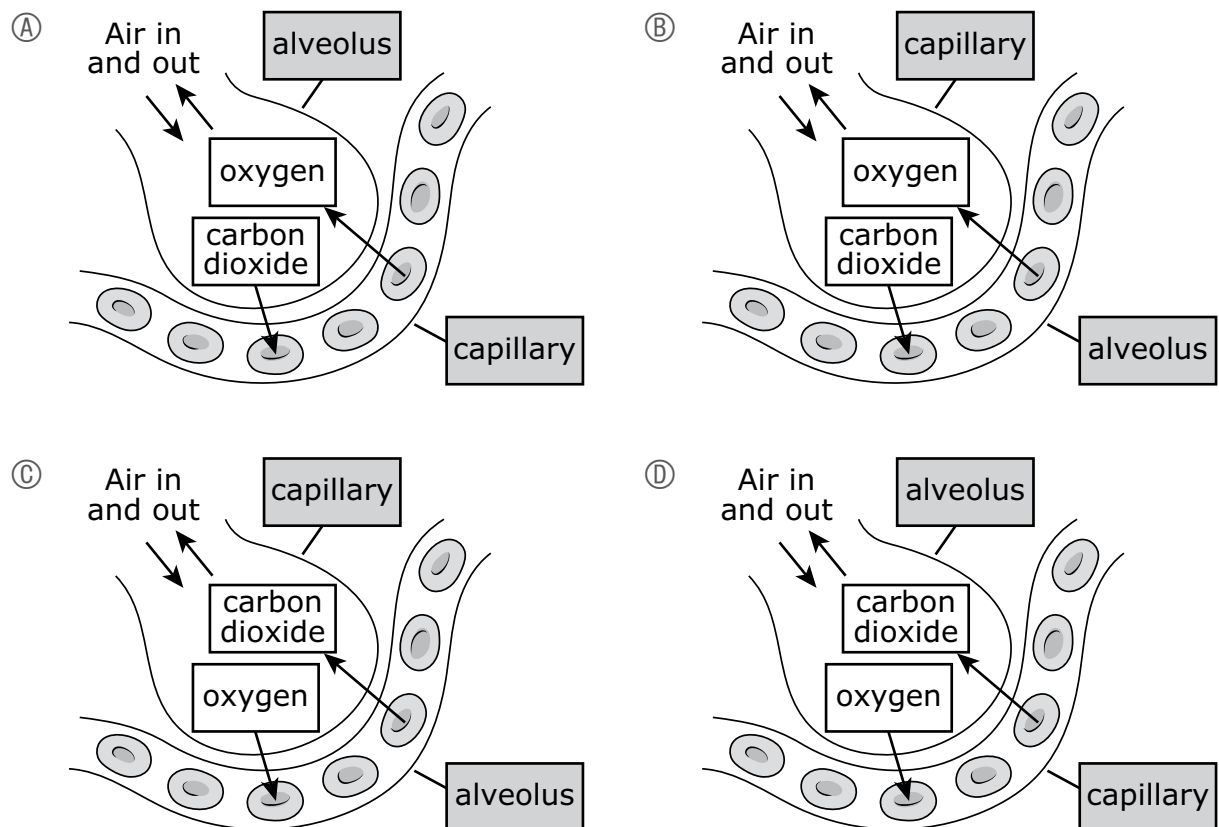
Ⓓ Meiosis occurs and offspring develop.

- 9 In fruit flies, the allele for light-brown color (**E**) is dominant to the allele for dark-brown color (**e**). A light-brown (**EE**) fruit fly is crossed with a dark-brown (**ee**) fruit fly.

What is the probability that the offspring from this cross will be dark brown?

- (A) 0
- (B) 0.25
- (C) 0.50
- (D) 1

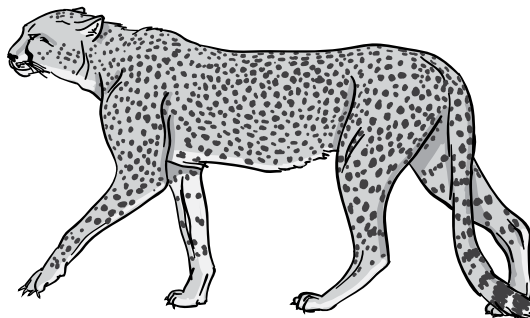
- 10 Which of the following models correctly shows gas exchange in a human lung?



The following section focuses on cheetahs.

Read the information below and use it to answer the selected-response questions and constructed-response question that follow.

Cheetahs (*Acinonyx jubatus*) are the world's fastest land animals. Cheetahs have many adaptations that allow them to accelerate and change direction quickly when chasing prey at high speeds. A picture of a cheetah is shown.



Cheetah populations are decreasing. Several factors have contributed to this decline. The cheetah's habitat has decreased due to human activities, including use of land for farming and housing developments. As a result of this decrease in habitat, encounters between cheetahs and other large predators, such as lions and hyenas, have become more common. Cheetahs are unable to fight off these large predators that often steal their food. Food sources of cheetahs include herbivores, such as antelopes and zebras.

The historic range of cheetahs included most of Africa and central Asia. Today, there are two main cheetah populations, one in Africa and the other hundreds of miles away in Asia. Both populations live in an area that is only a small fraction of their historic range.

The African cheetah population likely experienced a "bottleneck," or a severe decrease in population size, approximately 12,000 years ago. As a result, considerable inbreeding occurred as closely related individuals mated and produced offspring. The Asian population separated from the African population before the bottleneck. The size of the Asian population today is estimated to be fewer than 100 individuals.

- 11** Researchers studying cheetah reproduction found that 70% of the sperm cells produced by cheetahs were abnormal. An error in which process **most likely** caused the abnormal sperm cells to form?
- Ⓐ binary fission
 - Ⓑ cell-to-cell communication
 - Ⓒ homeostasis
 - Ⓓ meiosis
- 12** Which of the following would be the **most likely** result of cheetahs from the African population being introduced into the Asian population?
- Ⓐ a decrease in the birth rate of both the Asian population and the African population
 - Ⓑ a decrease in the food competition between the Asian population and the African population
 - Ⓒ an increase in the death rate of the Asian population due to predation by the African population
 - Ⓓ an increase in the genetic diversity of the Asian population due to mating with the African population

- 13** There are two coat varieties in cheetahs, king coats and normal coats. A cheetah with a king coat has larger spots than a cheetah with a normal coat. This coat variation is determined by a single gene with two alleles. When two cheetahs with normal coats are crossed, some of the cubs are expected to have king coats.

Based on the information, the inheritance pattern of coat variation in cheetahs is most likely

- Ⓐ codominance.
- Ⓑ dominant-recessive.
- Ⓒ incomplete dominance.

The allele for king coat is

- Ⓐ codominant.
- Ⓑ dominant.
- Ⓒ incompletely dominant.
- Ⓓ recessive.

This question has two parts.

- 14** The cheetah's habitat has changed due to human activities.

Part A

Habitat destruction threatens the cheetah's survival because it increases which of the following?

- Ⓐ mating between cheetahs and other cat species
- Ⓑ the number of environments to which cheetahs must adapt
- Ⓒ the average age at which cheetahs stop caring for their young
- Ⓓ competition for resources between cheetahs and other predators

Part B

The carrying capacity for cheetahs in Africa has

- Ⓐ decreased.
- Ⓑ increased.
- Ⓒ remained the same.

This is because, due to habitat destruction, the amount of food available to the antelopes and zebras has

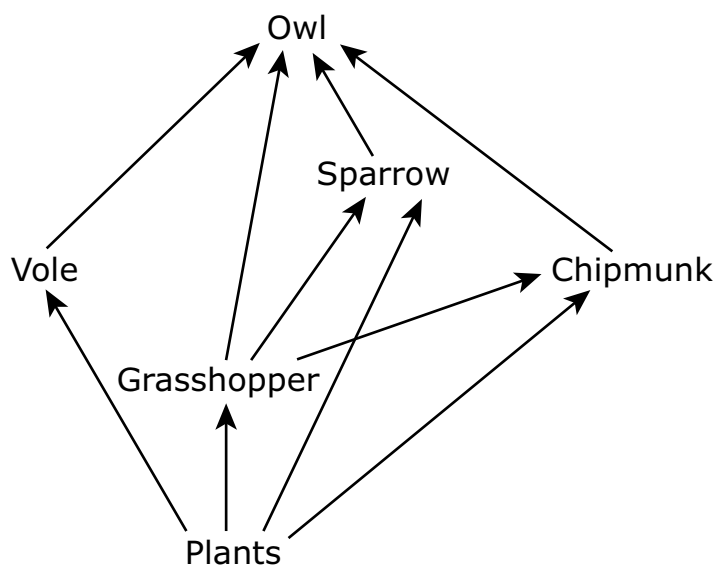
- Ⓐ decreased.
- Ⓑ increased.
- Ⓒ remained the same.

This question has two parts. Write your response on the next page. Be sure to label each part of your response.

- 15** With only about 100 wild Asian cheetahs left, individual cheetahs in this population are less likely to have traits that allow them to withstand an environmental change. For example, if a disease were introduced to the population, only a few individuals would likely be resistant to the disease.
- A. Identify one way disease resistance could be naturally introduced into the Asian cheetah population.
 - B. Using your knowledge of natural selection, explain how disease resistance could become more common in the cheetah population.

15

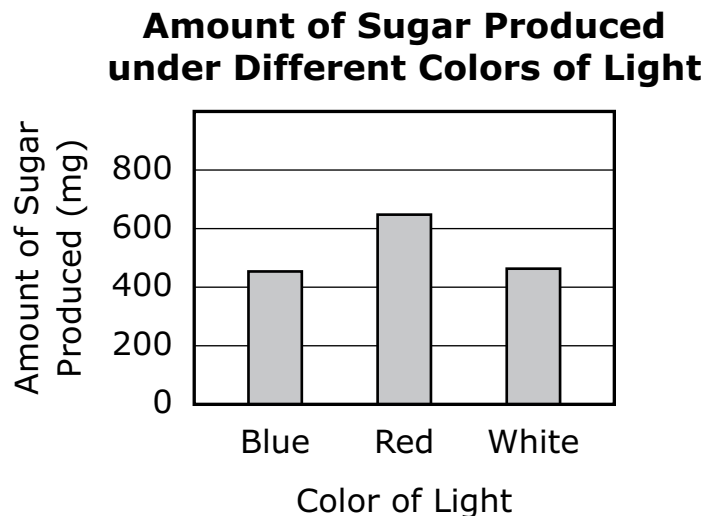
- 16 A forest ecosystem food web is shown.



The trophic level of plants in this ecosystem stores 10,000 kilocalories (kcal) of energy. What is the **maximum** amount of energy from the trophic level of plants that can be stored in the owl's trophic level?

- Ⓐ 1 kcal
- Ⓑ 10 kcal
- Ⓒ 100 kcal
- Ⓓ 1,000 kcal

- 17 Students wanted to find out whether different colors of light (blue, red, or white) would affect the amount of sugar produced in a species of plant. They randomly assigned four identical plants to each light color. All other growing conditions were the same. The graph shows the results of the students' investigation.



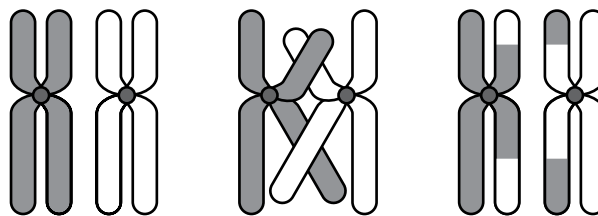
Which of the following describes the results of the students' investigation?

- Ⓐ The plants exposed to the red light performed the most photosynthesis.
- Ⓑ The plants exposed to the blue light performed the most photosynthesis.
- Ⓒ The plants exposed to the red light performed the most cellular respiration.
- Ⓓ The plants exposed to the blue light performed the most cellular respiration.

Therefore, these plants also produced the most

- Ⓐ carbon dioxide.
- Ⓑ oxygen.
- Ⓒ water.

- 18 The diagram shows how homologous chromosomes change during a cellular process.



Select the **two** descriptions that **best** apply to the process shown in the diagram.

- Ⓐ occurs in cytokinesis
- Ⓑ occurs during meiosis
- Ⓒ is caused by environmental factors
- Ⓓ increases genetic variation in a population
- Ⓔ decreases the number of genes in a chromosome

This question has four parts. Write your response on page 23. Be sure to label each part of your response.

- 19** Scientists sequenced the DNA from four cell types. Part of the DNA sequence from the same gene location of each cell type is shown in the table. One cell type has a mutation.

Cell Type	DNA Sequence
liver	GTA TCA GAA GAA
stomach	GTA TCA GAA GAA
skin	GTA TCA GAC GAA
sperm	GTA TCA GAA GAA

- A. Identify the cell type that has a mutation. Explain your reasoning using evidence from the table.
- B. Identify the mRNA sequence of the cell type with the mutation you identified in Part A **and** the mRNA sequence from a cell type without the mutation.

- C. The table below shows the amino acids coded for by mRNA codons.

mRNA Codon Table

UUU Phe	UCU Ser	UAU Tyr	UGU Cys
UUC Phe	UCC Ser	UAC Tyr	UGC Cys
UUA Leu	UCA Ser	UAA STOP	UGA STOP
UUG Leu	UCG Ser	UAG STOP	UGG Trp
CUU Leu	CCU Pro	CAU His	CGU Arg
CUC Leu	CCC Pro	CAC His	CGC Arg
CUA Leu	CCA Pro	CAA Gln	CGA Arg
CUG Leu	CCG Pro	CAG Gln	CGG Arg
AUU Ile	ACU Thr	AAU Asn	AGU Ser
AUC Ile	ACC Thr	AAC Asn	AGC Ser
AUA Ile	ACA Thr	AAA Lys	AGA Arg
AUG Met	ACG Thr	AAG Lys	AGG Arg
GUU Val	GCU Ala	GAU Asp	GGU Gly
GUC Val	GCC Ala	GAC Asp	GGC Gly
GUA Val	GCA Ala	GAA Glu	GGA Gly
GUG Val	GCG Ala	GAG Glu	GGG Gly

Identify the amino acid sequence that is coded for by each mRNA sequence you identified in Part B.

- D. Identify whether a phenotypic change is expected in the cell type with the mutation. Explain your reasoning.

19

B. mRNA sequence with mutation: _____

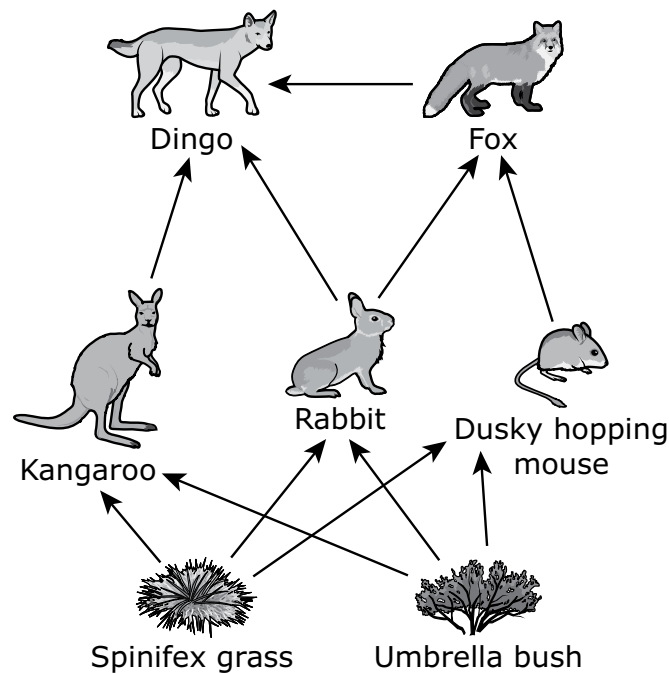
mRNA sequence without mutation: _____

C. amino acid sequence coded for
by mRNA with mutation: _____

amino acid sequence coded for
by mRNA without mutation: _____

This question has four parts. Write your response on the next page. Be sure to label each part of your response.

- 20** A food web for a grassland ecosystem in Australia is shown.



A fence was constructed to keep dingoes out of an area. The dingoes were not able to enter the fenced-in area. All of the other animals shown in the food web were able to move between the fenced-in area and the area outside the fence.

- Based on the food web, identify whether more kangaroos would be expected to be found in the fenced-in area or in the area outside the fence. Explain your reasoning.
- Based on the food web, identify whether more dusky hopping mice would be expected to be found in the fenced-in area or in the area outside the fence. Explain your reasoning.
- Based on the food web, identify whether the dusky hopping mice population would increase, decrease, or stay the same if there was a large decrease in the number of rabbits. Explain your reasoning.
- Scientists studying the dusky hopping mice found that the mice were more likely to be found in areas with above-average rainfall.

Based on the food web, explain why mice were more likely to be found in areas of higher average rainfall.

[illegible]

High School Biology SESSION 2

This session contains 21 questions.

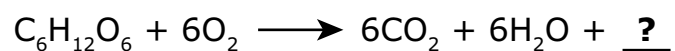
Directions

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For some questions, you will mark your answers by filling in the circles in your Test & Answer Booklet. Make sure you darken the circles completely. Do not make any marks outside of the circles. If you need to change an answer, be sure to erase your first answer completely.

If a question asks you to show or explain your work, you must do so to receive full credit. Write your response in the space provided. Only responses written within the provided space will be scored.

- 21** The model represents the process of cellular respiration.



A product of cellular respiration is missing from the model.

What product is missing from the model?

- Ⓐ ATP
- Ⓑ glucose
- Ⓒ protein

What does this product provide for life processes in cells?

- Ⓐ building blocks
- Ⓑ usable energy

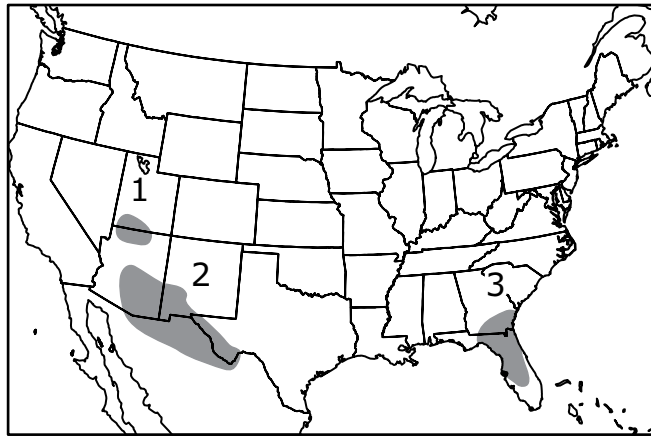
- 22** A paragraph about the passing of genetic information from parent to offspring is shown in the box. There is an error in the paragraph.

Egg cells are made in the process of meiosis. During meiosis, the nucleus is divided two times and four cells are produced. This results in haploid egg cells. Each egg cell is identical to ensure the same genetic information is passed to the offspring.

Which sentence contains the error?

- Ⓐ Egg cells are made in the process of meiosis.
- Ⓑ During meiosis, the nucleus is divided two times and four cells are produced.
- Ⓒ This results in haploid egg cells.
- Ⓓ Each egg cell is identical to ensure the same genetic information is passed to the offspring.

- 23** Yucca moths all descended from a single species of moth. Today, different species of yucca moths are found in different areas. The map shows the locations of these species, labeled 1, 2, and 3.

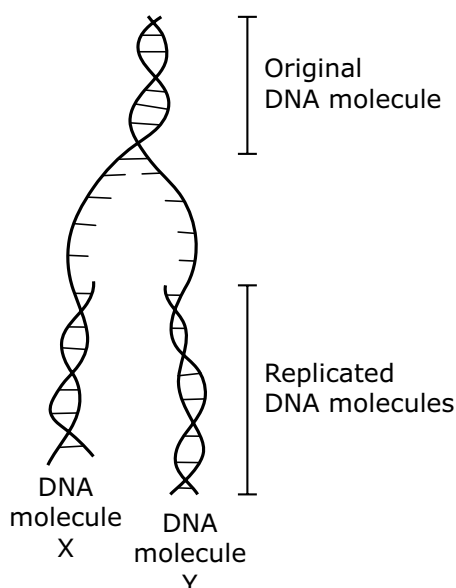


Which of the following explains how geographic separation resulted in different species of yucca moth?

- Ⓐ The populations of moths increased in size, and the moths became different species.
- Ⓑ Moth larvae in the moth populations ate seeds from different types of plants, and the moths became different species.
- Ⓒ The populations of moths were prevented from breeding with each other, and genetic differences between the populations increased, which led to different species.
- Ⓓ Adults in the moth populations reduced competition for plants by moving away from each other, allowing for increased lifespans that led to different species.

This question has two parts.

- 24** The diagram represents a simplified version of the process of DNA replication.



Part A

Which of the following ensures that the two replicated DNA molecules are both identical to the original DNA molecule?

- Ⓐ translation
- Ⓑ transcription
- Ⓒ sexual reproduction
- Ⓓ complementary base pairing

Part B

Which of the following **best** explains why DNA replication must happen before mitosis can occur?

- Ⓐ DNA can direct cell functions only after it has been replicated.
- Ⓑ Protein synthesis requires that two identical copies of DNA be present.
- Ⓒ Two copies of DNA are needed to produce identical cells during division.
- Ⓓ The amount of energy needed to replicate DNA is available only before mitosis.

- 25** A student has some genetic traits that are the same as his father's, like eye color and dimples. The student has other genetic traits that are different from his father's, like ear shape and hair color.

Which of the following **best** explains why the student has some genetic traits that are different from his father's traits?

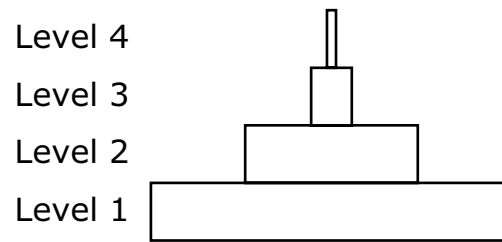
- Ⓐ The student inherited random genetic mutations from his father.
- Ⓑ The student inherited fewer genes from his mother than from his father.
- Ⓒ The student received about half of his genetic information from his mother.
- Ⓓ The student received fewer chromosomes from his father than from his mother.

- 26** The height of a pea plant may be affected by both genetics and the environment. A gene in pea plants that affects height has two alleles. The allele for tall pea plants (**T**) is dominant to the allele for short pea plants (**t**). If a pea plant does not receive enough sunlight or water, it may not grow as tall as pea plants that do receive enough sunlight and water.

Based on this information, the height of which of the following plants was affected **most** by environmental factors?

- Ⓐ a tall pea plant with a genotype of **Tt**
- Ⓑ a tall pea plant with a genotype of **TT**
- Ⓒ a short pea plant with a genotype of **tt**
- Ⓓ a short pea plant with a genotype of **Tt**

- 27 The diagram shows an energy pyramid for an ecosystem.

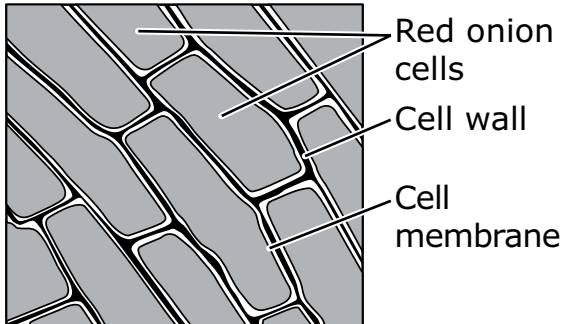


Which of the following **best** describes how energy is transferred in the ecosystem?

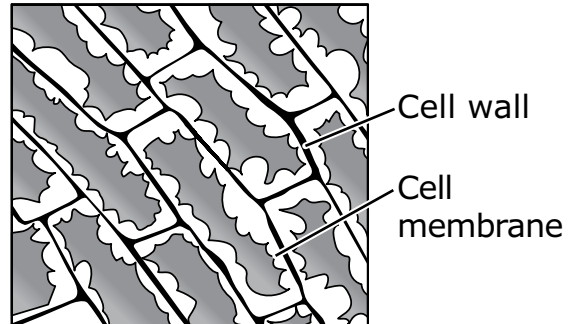
- Ⓐ Energy in trophic level 4 is transferred to the levels below through decomposition.
- Ⓑ Energy in a lower trophic level is transferred to the next higher trophic level through feeding relationships.
- Ⓒ Energy in trophic level 1 is transferred directly to each of the other trophic levels through the carbon cycle.
- Ⓓ Energy in a trophic level is transferred among the populations within that trophic level through competition.

- 28** A student prepared a slide with a single layer of red onion cells. After observing the onion cells under a microscope, the student added two drops of salt water to the slide. The student observed the onion cells again. The diagrams show the onion cells before and after salt water was added to the slide.

Onion Cells Before Adding Salt Water



Onion Cells After Adding Salt Water



The amount of water inside the cells

- Ⓐ increased.
- Ⓑ decreased.
- Ⓒ stayed the same.

This is a result of

- Ⓐ osmosis.
- Ⓑ active transport.

- 29** Radish plants produce a toxic substance when caterpillars feed on their leaves. This substance is harmful to caterpillars.

Which of the following **best** explains why the radish plants are able to produce this toxic substance?

- Ⓐ The radish plants create a new set of genes.
- Ⓑ The roots of the radish plants absorb a new substance.
- Ⓒ The radish plants change the number of leaves that grow on them.
- Ⓓ The genes of the radish plants are influenced by an environmental factor.

- 30** Photosynthetic algae live inside the cells of coral, a marine animal. Which of the following describes how photosynthesis performed by the algae helps the coral?

- Ⓐ The algae produce ATP during photosynthesis that the coral can use to make oxygen.
- Ⓑ The algae make glucose during photosynthesis that the coral can use to produce energy.
- Ⓒ The algae attract light during photosynthesis that the coral can use to identify predators.
- Ⓓ The algae release carbon dioxide during photosynthesis that the coral can use for respiration.

- 31** The table lists two conditions, X and Y, that can occur in the digestive system.

Condition X	Acid produced by this organ begins to dissolve some of its tissue lining.
Condition Y	Infection of this organ slows the absorption of nutrients into the bloodstream.

Which of the following organs is most directly affected by condition X?

- Ⓐ large intestine
- Ⓑ small intestine
- Ⓒ stomach

Which of the following organs is most directly affected by condition Y?

- Ⓐ large intestine
- Ⓑ small intestine
- Ⓒ stomach

The following section focuses on human blood types.

Read the information below and use it to answer the selected-response questions and constructed-response question that follow.

Human blood types are categorized based on the ABO blood group system. In this system, an individual has one of four different blood types: A, B, AB, or O. These four blood types result from interactions of the alleles **A**, **B**, and **O**.

The **A**, **B**, and **O** alleles code for various forms of an enzyme involved in the production of molecules called antigens. Antigens are found on the surface of red blood cells. The table shows how the three alleles interact.

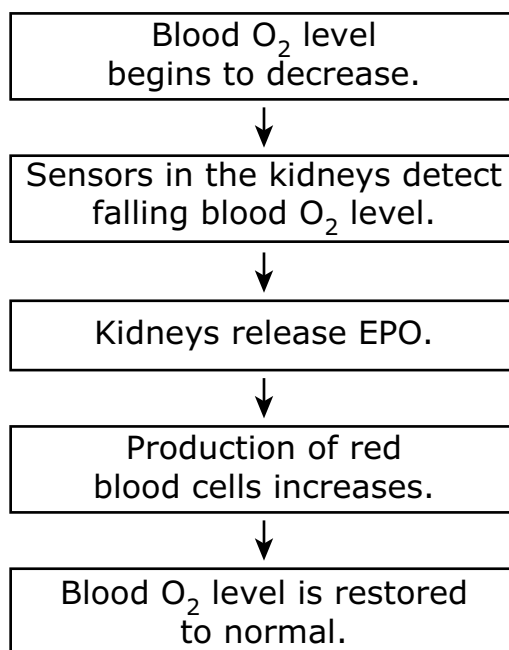
Allele	Interaction with Allele A	Interaction with Allele B	Interaction with Allele O
A	—	codominant with B	dominant to O
B	codominant with A	—	dominant to O
O	recessive to A	recessive to B	—

A person who needs a blood transfusion must receive a compatible blood type. If the person receives an incompatible blood type, their immune system will react to the antigens in the blood by producing proteins called antibodies. The antibodies will attack the antigens, causing the blood to clump in the person's blood vessels. To prevent such complications, blood-type compatibility is always tested before a blood transfusion.

- 32** The antibodies produced by a person's immune system are made up of
- Ⓐ amino acids.
 - Ⓑ fatty acids.
 - Ⓒ nucleotides.
 - Ⓓ phospholipids.
- 33** Select **two** genotypes that both code for the same blood type.
- Ⓐ **AA**
 - Ⓑ **AB**
 - Ⓒ **AO**
 - Ⓓ **BO**
 - Ⓔ **OO**
- 34** Scientists who study the evolution of ABO blood types discovered that these blood types have existed for millions of years. Which of the following **best** explains how natural selection could have led the human population to have several blood types rather than just one?
- Ⓐ Each blood type was made with different carbohydrates and lipids, so people with a certain blood type ate different foods.
 - Ⓑ People with different blood types had different numbers of genes, so they only reproduced with other people with the same blood type.
 - Ⓒ People with different blood types had many mutations, so they learned to adapt their blood type to match the environment they lived in.
 - Ⓓ Each blood type was favored in different environments, so people with a certain blood type were more likely to survive and reproduce in a particular environment.
-

This question has two parts.

- 35** The production of red blood cells is affected by the amount of oxygen (O_2) in a person's blood and the release of the hormone erythropoietin (EPO). A model of how red blood cell production is affected by O_2 and EPO is shown.



Part A

Which of the following claims is supported by the model?

- Ⓐ Kidneys break down O_2 when EPO is released.
- Ⓑ Kidneys decrease the amount of O_2 produced.
- Ⓒ EPO is released when blood O_2 levels are above normal.
- Ⓓ Red blood cell production begins to increase when O_2 blood levels decrease.

Part B

Once blood O₂ levels have been restored to normal, the level of EPO

- Ⓐ increases.
- Ⓑ decreases.

This allows the number of red blood cells in the body to

- Ⓐ increase.
- Ⓑ decrease.
- Ⓒ be maintained.

This question has three parts. Write your response on the next page. Be sure to label each part of your response.

36 Two parents, a father who is heterozygous for blood type A and a mother with blood type O, had biological children.

- A. Using the allele symbols **A**, **B**, and **O**, complete the Punnett square on the next page to show this cross.
- B. Based on the Punnett square, identify the expected percentage of biological children with blood type O. Explain your reasoning.
- C. One of the female children grew up and had a biological child. The child has blood type AB.

Identify the genotype of this child's mother **and** a possible genotype of the biological father. Explain your reasoning.

A.

[illegible]

- 37 The table compares genome sizes and mutation rates of a type of virus, a bacterium species, and a fungus species.

The genome size is the approximate number of nucleotide base pairs. The mutation rate is the number of mutations that occur in the amount of time it takes the fungus to develop one mutation. For example, for each mutation that occurs in the fungus species, 1,329 mutations occur in the bacterium species over the same time period.

	Genome Size	Mutation Rate
Virus	5,590	588,235
Bacterium	5,000,000	1,329
Fungus	13,800,000	1

The virus is able to adapt to environmental changes

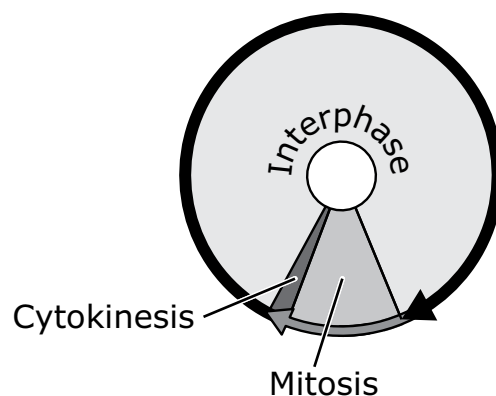
- Ⓐ faster than the fungus.
- Ⓑ slower than the bacterium.

This is because, compared with the fungus and the bacterium, the virus has a

- Ⓐ smaller genome size.
- Ⓑ higher mutation rate.

- 38** Select **two** ways that photosynthesis supports life on Earth.
- Ⓐ The flow of energy through most ecosystems begins with photosynthesis.
 - Ⓑ The energy released during photosynthesis is used by other organisms to reproduce.
 - Ⓒ Plants use lipids made during photosynthesis to decompose materials in ecosystems.
 - Ⓓ Animals use carbon dioxide released during photosynthesis to break down food for energy.
 - Ⓔ A type of molecule produced during photosynthesis is the primary source of organic material for most ecosystems.

- 39 A model of the cell cycle is shown.



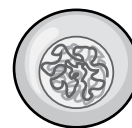
Which of the following shows an event that occurs during interphase in the cell cycle?

(A)



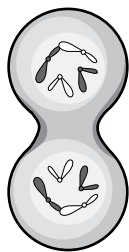
Chromosomes line up in the middle of a cell.

(B)



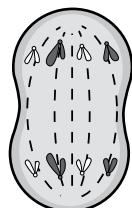
DNA is replicated in a nucleus of a cell.

(C)



Two nuclei form in a cell.

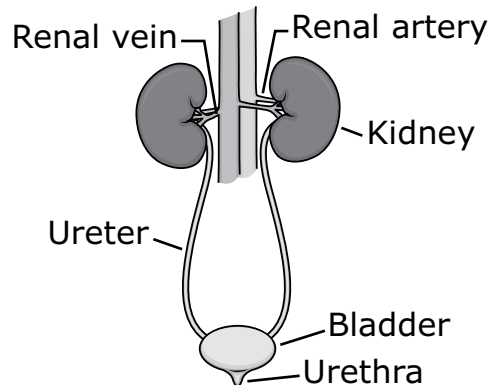
(D)



Chromosomes are separated in a cell.

This question has two parts.

- 40** Part of the human excretory system is shown in the diagram.



Part A

Which of the following is a main function of the kidneys?

- Ⓐ to filter waste from the blood
- Ⓑ to control the exchange of gas
- Ⓒ to transmit signals from the ureters
- Ⓓ to break down carbohydrates with enzymes

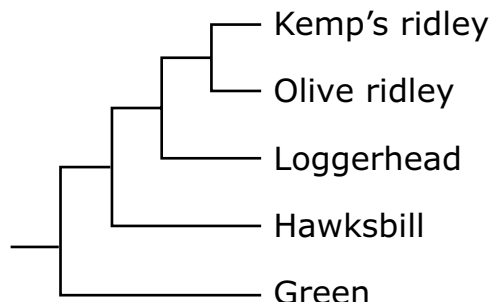
Part B

Which of the following best describes how the kidneys help to maintain homeostasis?

- Ⓐ They help to regulate the feedback loop for the body.
- Ⓑ They help to regulate the volume of water in the body.
- Ⓒ They help to regulate the temperature of all body cells.
- Ⓓ They help to regulate the oxygen level in all body cells.

This question has three parts. Write your response on the next page. Be sure to label each part of your response.

- 41** Five species of sea turtles share a common ancestor, as shown in the cladogram. The cladogram was created using different types of scientific evidence.



- A. Based on the cladogram, identify the two sea turtle species that are most closely related.
- B. Identify one type of evidence that scientists most likely used to create the cladogram. Explain how the evidence can be used by scientists to determine the relatedness of sea turtles.
- C. Identify **another** type of evidence that scientists most likely used to create the cladogram. Explain how the evidence can be used by scientists to determine the relatedness of sea turtles.

41

High School Biology

Spring 2026 Released Operational Items

PBT Item No.*	Page No.	Reporting Category	Standard	Science Practice Category	Item Type**	Item Description	Correct Answer (SR)***
1	4	<i>Heredity</i>	HS.LS.3.4	A. Investigations and Questioning	SR	Analyze data to determine whether characteristics of a plant are more likely the result of genetic or environmental factors.	D
2	5	<i>Heredity</i>	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Identify the final products after a cell completes meiosis.	D
3	6	<i>Molecules to Organisms</i>	HS.LS.1.7	A. Investigations and Questioning	SR	Analyze an investigation to identify changes that should be made to better determine the rate of cellular respiration in yeast cells.	C,E
4	7	<i>Molecules to Organisms</i>	HS.LS.1.3	None	SR	Describe how homeostasis is restored in a feedback loop.	B
5	8	<i>Molecules to Organisms</i>	HS.LS.1.6	B. Mathematics and Data	SR	Analyze a graph to determine how nitrogen availability affects the growth of certain trees and determine that this affects the tree's ability to produce structural proteins.	A;B
6	9	<i>Ecology</i>	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	SR	Identify the ecological role of an organism based on a food web.	A
7	10	<i>Ecology</i>	HS.LS.2.5	None	SR	Identify a carbon cycle process that moves carbon in an ecosystem.	B
8	10	<i>Heredity</i>	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Complete a model of sexual reproduction.	C
9	11	<i>Heredity</i>	HS.LS.3.3	B. Mathematics and Data	SR	Determine the probability of offspring with a certain phenotype from a given genetic cross.	A
10	11	<i>Molecules to Organisms</i>	HS.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Identify a model of gas exchange in a human lung.	D
11	13	<i>Heredity</i>	HS.LS.3.1	None	SR	Identify the process that produces gametes.	D
12	13	<i>Ecology</i>	HS.LS.2.2	C. Evidence, Reasoning, and Modeling	SR	Explain the most likely effect on genetic diversity when individuals from one population are introduced into a different population.	D
13	14	<i>Heredity</i>	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	SR	Determine the most likely inheritance pattern for a trait based on given information.	B;D
14	15	<i>Ecology</i>	HS.LS.2.1	C. Evidence, Reasoning, and Modeling	SR	Explain how habitat destruction affects the survival of a population and determine how changes in food availability impact the carrying capacity for the population.	D;A;A

PBT Item No.*	Page No.	Reporting Category	Standard	Science Practice Category	Item Type**	Item Description	Correct Answer (SR)***
15	16–17	<i>Evolution</i>	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	CR	Identify how an adaptation can become part of the gene pool and explain how that adaptation can become more common in the population over time.	
16	18	<i>Ecology</i>	HS.LS.2.4	B. Mathematics and Data	SR	Calculate the maximum amount of energy at a certain trophic level based on the amount of energy in the trophic level of plants in a food web.	C
17	19	<i>Molecules to Organisms</i>	HS.LS.1.5	B. Mathematics and Data	SR	Interpret a graph to determine how the color of light affects photosynthesis and oxygen production.	A;B
18	20	<i>Heredity</i>	HS.LS.3.2	C. Evidence, Reasoning, and Modeling	SR	Identify two descriptions of crossing over based on a diagram.	B,D
19	21–23	<i>Molecules to Organisms</i>	HS.LS.1.1	C. Evidence, Reasoning, and Modeling	CR	Analyze DNA sequences to explain why a cell has a mutation, determine mRNA and amino acid sequences based on DNA sequences, and explain why the mutation is not likely to cause a phenotypic change.	
20	24–25	<i>Ecology</i>	HS.LS.2.7	C. Evidence, Reasoning, and Modeling	CR	Analyze a food web to explain how populations would change under different environmental conditions and when another population in the food web decreases, and explain why a population increased with increased rainfall.	
21	27	<i>Molecules to Organisms</i>	HS.LS.1.7	C. Evidence, Reasoning, and Modeling	SR	Complete a model of cellular respiration and describe how the missing product is used in cells.	A;B
22	28	<i>Heredity</i>	HS.LS.3.2	None	SR	Identify an error in a description of meiosis.	D
23	29	<i>Evolution</i>	HS.LS.4.5	C. Evidence, Reasoning, and Modeling	SR	Explain how geographic isolation of populations led to the formation of different species.	C
24	30	<i>Molecules to Organisms</i>	HS.LS.1.4	C. Evidence, Reasoning, and Modeling	SR	Use a model to determine the process that ensures replicated DNA is identical to the original DNA, and explain why DNA replication must occur before mitosis.	D;C
25	31	<i>Heredity</i>	HS.LS.3.1	None	SR	Explain why an organism has some genetic traits that are different from one of its parents.	C
26	31	<i>Heredity</i>	HS.LS.3.4	C. Evidence, Reasoning, and Modeling	SR	Analyze phenotype and genotype data to determine which plant was most affected by an environmental factor.	D
27	32	<i>Ecology</i>	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	SR	Describe how energy is transferred in an ecosystem based on an energy pyramid.	B

PBT Item No.*	Page No.	Reporting Category	Standard	Science Practice Category	Item Type**	Item Description	Correct Answer (SR)***
28	33	<i>Molecules to Organisms</i>	HS.LS.1.3	C. Evidence, Reasoning, and Modeling	SR	Explain how adding salt water to plant cells affects the amount of water inside the cells and identify the process responsible for the movement of water.	B;A
29	34	<i>Heredity</i>	HS.LS.3.4	C. Evidence, Reasoning, and Modeling	SR	Explain that certain plants are able to produce a toxic substance due to an environmental factor.	D
30	34	<i>Molecules to Organisms</i>	HS.LS.1.5	None	SR	Explain how photosynthesis by algae living inside coral cells helps the coral.	B
31	35	<i>Molecules to Organisms</i>	HS.LS.1.2	None	SR	Identify digestive system organs most directly affected by certain conditions.	C;B
32	37	<i>Molecules to Organisms</i>	HS.LS.1.6	None	SR	Identify the monomer that makes up antibodies.	A
33	37	<i>Heredity</i>	HS.LS.3.3	None	SR	Determine which two genotypes code for the same phenotype.	A,C
34	37	<i>Evolution</i>	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	SR	Explain how natural selection could have resulted in a population having several phenotypes for a certain trait.	D
35	38–39	<i>Molecules to Organisms</i>	HS.LS.1.3	C. Evidence, Reasoning, and Modeling	SR	Interpret a model to evaluate claims and explain feedback mechanisms that maintain homeostasis in the given situation.	D;B;C
36	40–41	<i>Heredity</i>	HS.LS.3.3	B. Mathematics and Data	CR	Complete a Punnett square to predict offspring phenotypes, identify and explain the expected percentage of a phenotype, and identify and explain possible genotypes of parents based on an offspring with a certain phenotype.	
37	42	<i>Evolution</i>	HS.LS.4.4	B. Mathematics and Data	SR	Analyze a data table to explain why viruses adapt to environmental changes faster than other organisms.	A;B
38	43	<i>Ecology</i>	HS.LS.2.5	None	SR	Identify two ways that photosynthesis supports life on Earth.	A,E
39	44	<i>Molecules to Organisms</i>	HS.LS.1.4	C. Evidence, Reasoning, and Modeling	SR	Identify an event that occurs in the cell cycle during interphase.	B
40	45	<i>Molecules to Organisms</i>	HS.LS.1.2	None	SR	Describe the primary function of the kidneys and explain how the kidneys help to maintain homeostasis in the human body.	A;B
41	46–47	<i>Evolution</i>	HS.LS.4.1	C. Evidence, Reasoning, and Modeling	CR	Interpret a cladogram to identify the most closely related species and explain how different types of evidence can be used to determine evolutionary relatedness.	

* The 2026 Biology test results were reported using 58 points instead of 60 points. DESE excluded one two-point test question that students reported having technology difficulties with during test administration. This question did not count toward any student's score.

** Science item types are: selected-response (SR) and constructed-response (CR).

*** Answers are provided here for selected-response items only. Sample responses and scoring guidelines for constructed-response items will be posted to the Department's website later this year.