Computer-Based Released Items
High School Biology MCAS
Spring 2024

The spring 2024 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.

The Department of Elementary and Secondary Education is releasing items from both versions of the test to provide information about the knowledge and skills that students are expected to demonstrate.

- Released items from the computer-based test are available online at mcas.onlinehelp.cognia.org/released-items. The computer-based released items are collected in a "mini test" called an ePAT (electronic practice assessment tool). Items in the ePAT are displayed in TestNav 8, the testing platform for the computer-based tests.

- Released items from the paper-based test are available in PDF format on the Department's website at www.doe.mass.edu/mcas/release.html.

This document provides information about each released item from the *computer-based test*, including the following: reporting category, standard covered, science practice category covered (if any), item type, and item description. Answers are provided for selected-response items only. Sample student responses and scoring guides for constructed-response items will be posted at www.doe.mass.edu/mcas/student/.

A Note about Testing Mode

Most of the operational items on the 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.

High School Biology
Spring 2024 Computer-Based Released Operational Items

CBT Item No.	Reporting Category	Standard	Science Practice Category	Item Type*	Item Description	Correct Answer (SR)**
1	*Molecules to Organisms*	HS.LS.1.4	None	SR	Identify cellular processes that lead to growth of an organism.	A
2	*Heredity*	HS.LS.3.1	None	SR	Explain why there is difference in chromosome number between an egg cell and a zygote.	D
3	*Molecules to Organisms*	HS.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Describe the function of a body system based on a diagram.	C
4	*Ecology*	HS.LS.2.5	None	SR	Describe how carbon is cycled from the atmosphere to living organisms.	A
5	*Molecules to Organisms*	HS.LS.1.1	C. Evidence, Reasoning, and Modeling	SR	Complete a model of the transcription of a DNA sequence.	*see page 6*
6	*Heredity*	HS.LS.3.4	B. Mathematics and Data	SR 2 pt.	Analyze a graph to determine which trait is most influenced by genetics and explain why some individuals share more traits than others.	Part A: *see page 6* Part B: C
7	*Molecules to Organisms*	HS.LS.1.5	None	SR	Determine how photosynthetic phytoplankton support other organisms in an ecosystem.	*see page 6*
8	*Heredity*	HS.LS.3.2	A. Investigations and Questioning	SR	Identify a question that, when answered, would determine whether a genetic condition can be passed to offspring.	A
9	*Molecules to Organisms*	HS.LS.1.3	None	SR	Determine that blood glucose levels returning to normal is an example of homeostasis.	A
10	*Ecology*	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	SR	Interpret a food web to determine the ecological roles of several organisms.	*see page 6*
11	*Molecules to Organisms*	HS.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Determine the parts of the respiratory system in humans that are most closely related to the movement of oxygen and carbon dioxide.	*see page 6*
12	*Molecules to Organisms*	HS.LS.1.6	None	SR	Identify two elements found in a certain organic molecule.	C
13	*Evolution*	HS.LS.4.5	A. Investigations and Questioning	SR	Identify a testable question that, when answered, would help researchers determine whether speciation has occurred.	C
14	*Evolution*	HS.LS.4.2	None	SR	Describe a condition that is necessary for natural selection to occur.	A

15	*Ecology*	HS.LS.2.2	B. Mathematics and Data	SR 2 pt.	Analyze data to determine which evidence best supports a conclusion that a population was affected by predation and analyze graphs to determine which one best shows how a population changed over time.	C;B
16	*Heredity*	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	CR 3 pt.	Complete a Punnett square for a genetic cross between two heterozygous individuals, determine the percentage of offspring that would inherit a certain trait, and explain how the trait affects the fitness of an individual in a particular environment.	
17	*Heredity*	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Determine the gametes that would be produced by a parent cell with a given genotype.	B
18	*Molecules to Organisms*	HS.LS.1.6	None	SR	Classify an organic molecule based on its chemical components.	C
19	*Ecology*	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	SR	Identify the model that shows the relative amount of energy in different trophic levels.	D
20	*Ecology*	HS.LS.2.1	None	CR 4 pt.	Compare birth and death rates in a population that is increasing and explain how environmental factors could affect the death rate and birth rate in a population.	
21	*Molecules to Organisms*	HS.LS.1.7	B. Mathematics and Data	CR 4 pt.	Identify the gas consumed and the gas produced during cellular respiration, analyze a graph to determine when organisms are moving and at rest, and analyze another graph to determine whether a prediction is correct and explain the reasoning.	
22	*Heredity*	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	SR	Determine the possible genotypes of an organism based on the organism's phenotype.	D
23	*Evolution*	HS.LS.4.4	None	SR	Identify a reproductive advantage that bacteria have but viruses do not.	C
24	*Heredity*	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Describe how a model shows the segregation of alleles during meiosis.	A
25	*Ecology*	HS.LS.2.7	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Describe how the introduction of an invasive species affects the biodiversity of native species in an ecosystem and explain how an invasive species may increase over time.	A;D
26	*Heredity*	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	SR	Analyze a pedigree to determine the inheritance pattern of a genetic condition.	*see page 6*
27	*Heredity*	HS.LS.3.2	None	SR	Determine which evidence would best support a claim that an error occurred during meiosis.	B

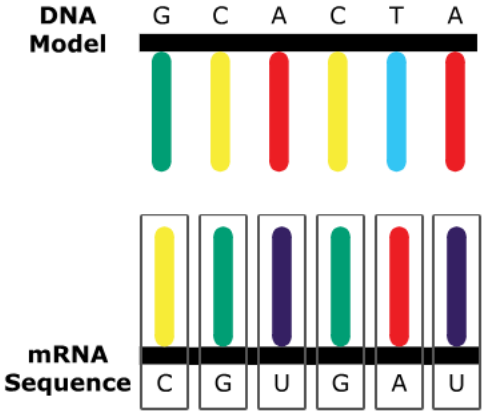
28	*Evolution*	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	SR	Explain how an insect population can become resistant to a pesticide after many generations.	D
29	*Molecules to Organisms*	HS.LS.1.6	B. Mathematics and Data	SR	Determine the percentages of three DNA nucleotide bases when given the percentage of the fourth nucleotide base.	*see page 7*
30	*Heredity*	HS.LS.3.3	B. Mathematics and Data	SR	Interpret a graph of offspring phenotypes to determine the genotypes of the parental cross.	A
31	*Molecules to Organisms*	HS.LS.1.2	None	SR	Explain why a large amount of blood passes through the kidneys in humans.	B
32	*Heredity*	HS.LS.3.4	B. Mathematics and Data	SR	Analyze heritability data to determine the traits that are more likely determined by the environment than by genetics.	*see page 7*
33	*Molecules to Organisms*	HS.LS.1.1	None	SR	Classify a type of organic molecule based on its function.	D
34	*Evolution*	HS.LS.4.1	C. Evidence, Reasoning, and Modeling	SR	Analyze a cladogram to support a claim about the relatedness of organisms.	A
35	*Ecology*	HS.LS.2.1	C. Evidence, Reasoning, and Modeling	SR	Describe evidence of two organisms having a mutualistic relationship.	D
36	*Molecules to Organisms*	HS.LS.1.4	None	SR 2 pt.	Identify the process that replaces damaged cells in an organism and describe the genetic makeup of the cells produced by the process.	C;A
37	*Evolution*	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	CR 3 pt.	Explain why individuals with a particular trait are more likely to survive in a certain environment and how having multiple mates can increase genetic diversity in a population.	
38	*Molecules to Organisms*	HS.LS.1.5	B. Mathematics and Data	SR	Interpret a graph to determine which temperature supported more plant growth and determine the gas produced and the process performed by the plants.	*see page 7*
39	*Molecules to Organisms*	HS.LS.1.3	None	SR	Identify the process used to move oxygen across a cell membrane.	D
40	*Heredity*	HS.LS.3.2	None	SR	Determine the cause of a mutation in an offspring.	C
41	*Molecules to Organisms*	HS.LS.1.3	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Complete a model of a feedback loop and explain why the model is a negative feedback loop.	Part A: *see page 7* Part B: D

42	*Evolution*	HS.LS.4.5	A. Investigations and Questioning	CR 4 pt.	Write a testable question that, when answered, could determine whether a trait is the result of natural selection, explain how a piece of evidence could support two organisms being different species, and explain how geographic isolation can lead to speciation.	

* Science item types are selected-response (SR) and constructed-response (CR). All selected-response items are worth 1 point unless otherwise noted.

**Answers are provided here for selected-response items only. Pages 6 through 7 of this document provide correct answers for technology-enhanced (TE) items. Sample student responses and scoring guides for constructed-response items will be posted at www.doe.mass.edu/mcas/student/.

Correct Answer for CBT Item #5: Technology-Enhanced Item



Correct Answer for CBT Item #6 Part A: Technology-Enhanced Item

The graph indicates that having [the same height] is more likely influenced by genetics than the other traits.

Correct Answer for CBT Item #7: Technology-Enhanced Item

Phytoplankton support other aquatic organisms by producing [oxygen.]

Correct Answer for CBT Item #10: Technology-Enhanced Item

Organism	Producer	Primary Consumer	Secondary Consumer	Tertiary Consumer
blue jay	○	○	◉	○
caterpillar	○	◉	○	○
squirrel	○	◉	○	○

Correct Answers for CBT Item #11: Technology-Enhanced Item

This function of a frog's skin is most closely related to the function of [alveoli] in the [respiratory] system of humans.

Correct Answer for CBT Item #26: Technology-Enhanced Item

Based on the information, the genetic condition is caused by a [recessive] allele on the [X] chromosome.

Correct Answer for CBT Item #29: Technology-Enhanced Item

Nucleotide Base	Percentage of DNA Molecule
adenine (A)	32
cytosine (C)	18
guanine (G)	18
thymine (T)	32

Correct Answers for CBT Item #32: Technology-Enhanced Item

If a sheep farmer wanted to breed sheep for traits, the farmer would be **least** successful when selectively breeding for milk production and birth weight because those traits are mostly a result of the environment.

OR

If a sheep farmer wanted to breed sheep for traits, the farmer would be **least** successful when selectively breeding for birth weight and milk production because those traits are mostly a result of the environment.

Correct Answer for CBT Item #38: Technology-Enhanced Item

The most likely reason the total mass of the plants from each group was different is because the plants grown at 20°C produced more glucose during photosynthesis.

Correct Answers for CBT Item #41 Part A: Technology-Enhanced Item

1. Person starts running.
2. Muscle cells release more carbon dioxide into the blood.
3. Blood pH decreases.
4. Brain cells detect decreasing blood pH.
5. Brain sends messages to the muscles that control breathing.
6. Breathing rate increases, more carbon dioxide is exhaled, and blood pH increases.