Computer-Based Released Items
MCAS Science and Technology/Engineering
Biology Spring 2022

The spring 2022 Biology test was administered in two primary formats: a computer-based version and a paper-based version. The vast majority of students took the computer-based test. The paper-based test was offered as an accommodation for students with disabilities who are unable to use a computer, as well as for English learners who are new to the country and are unfamiliar with technology.

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.pearsonsupport.com/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 reporting category, standard covered, 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 Spring 2022 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 STE content and assessed the same standard as the technology-enhanced item.

High School Biology
Spring 2022 Computer-Based Released Operational Items

CBT Item No.	Reporting Category	Standard	Science and Engineering Practice Category	Item Type*	Item Description	Correct Answer (SR)**
1	Molecules to Organisms	HS.LS.1.7	A. Investigations and Questioning	SR	Determine which measurement would best support a claim about usable energy in cells.	A
2	Heredity	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Describe the chromosomes shown in a karyotype diagram.	*see page 5*
3	Ecology	HS.LS.2.6	C. Evidence, Reasoning, and Modeling	SR	Analyze a food web to identify organisms that compete with an invasive species in an ecosystem.	*see page 5*
4	Molecules to Organisms	HS.LS.1.1	C. Evidence, Reasoning, and Modeling	SR	Describe how a model of mRNA should be revised to replace nucleotides that were transcribed incorrectly.	*see page 5*
5	Molecules to Organisms	HS.LS.1.4	None	SR	Complete a table to show processes occurring during three phases of the cell cycle.	*see page 6*
6	Ecology	HS.LS.2.4	B. Mathematics and Data	SR 2 pt.	Calculate the amount of energy transferred between trophic levels and identify two factors that limit the amount of energy transferred.	C;B,C
7	Evolution	HS.LS.4.4	None	SR	Explain why bacteria are able to adapt to changing environments.	B
8	Ecology	HS.LS.2.5	None	SR	Determine whether carbon atoms are stored as biomass or released into the environment for three carbon cycle processes.	*see page 6*
9	Molecules to Organisms	HS.LS.1.2	B. Mathematics and Data	SR	Analyze data to explain the movement of gases between the circulatory and respiratory systems.	D
10	Heredity	HS.LS.3.4	None	SR	Determine that a particular characteristic is a result of both genetics and the environment.	C
11	Evolution	HS.LS.4.1	None	SR	Explain how modern organisms can inherit genes that no longer function even though their ancestors had a functional version of the gene.	D
12	Heredity	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	SR	Use evidence from genetic crosses to support a claim about the inheritance pattern of a particular trait.	D
13	Evolution	HS.LS.4.5	A. Investigations and Questioning	SR	Identify a question that scientists can answer by analyzing the results of a cross-breeding experiment.	A
14	Evolution	HS.LS.4.2	C. Evidence, Reasoning, and Modeling	SR	Describe how a particular trait in a population will change over time when a resource in the environment changes.	D

15	Heredity	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Identify the types of cells that combine to produce an offspring and compare the number of chromosomes in a gamete to a body cell.	A,E;B
16	Molecules to Organisms	HS.LS.1.5	C. Evidence, Reasoning, and Modeling	CR 3 pt.	Complete a model of photosynthesis, identify the source of energy for photosynthesis, and describe how the products of photosynthesis are used in a human cell.	
17	Molecules to Organisms	HS.LS.1.1	B. Mathematics and Data	SR	Analyze a model to determine the number of DNA nucleotides that code for a chain of amino acids.	D
18	Heredity	HS.LS.3.1	C. Evidence, Reasoning, and Modeling	SR	Analyze a diagram to determine whether normal meiosis occurred and use evidence to support the claim.	B
19	Molecules to Organisms	HS.LS.1.3	C. Evidence, Reasoning, and Modeling	SR	Analyze a model of a feedback loop to describe the function of the feedback loop.	C
20	Molecules to Organisms	HS.LS.1.6	C. Evidence, Reasoning, and Modeling	CR 4 pt.	Use models to identify which monomers make up organic macromolecules and describe how these organic macromolecules are used in cells.	
21	Heredity	HS.LS.3.3	C. Evidence, Reasoning, and Modeling	CR 4 pt.	Identify possible parental genotypes for a dominant-recessive genetic condition and a x-linked genetic condition and complete Punnett squares to determine the expected percentages of offspring that will inherit the conditions.	
22	Molecules to Organisms	HS.LS.1.3	None	SR	Describe how the process of diffusion helps to maintain homeostasis in cells.	*see page 6*
23	Heredity	HS.LS.3.2	C. Evidence, Reasoning, and Modeling	SR	Use evidence from a model to support a claim that meiosis increases genetic variability.	*see page 6*
24	Molecules to Organisms	HS.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Complete a model to show the functions of three parts of the digestive system.	*see page 7*
25	Heredity	HS.LS.3.4	B. Mathematics and Data	SR 2 pt.	Analyze data to determine the effect of an environmental factor on the expression of a gene and describe how a gene is expressed to produce a protein.	*see page 7*
26	Molecules to Organisms	HS.LS.1.2	A. Investigations and Questioning	SR	Determine one piece of evidence that would show a kidney is functioning normally.	D
27	Heredity	HS.LS.3.2	B. Mathematics and Data	SR	Analyze four single-base mutations and their resulting codons to determine which mutation would not result in a phenotypic change.	C
28	Evolution	HS.LS.4.1	C. Evidence, Reasoning, and Modeling	SR	Complete a cladogram using differences in amino acid sequences to determine the evolutionary relatedness of several species.	*see page 8*

| 29	Molecules to Organisms	HS.LS.1.4	B. Mathematics and Data	SR	Determine the percentage of a nitrogenous base in a sample of DNA when given the percentage of another nitrogenous base in the same sample.	B
30	Evolution	HS.LS.4.1	C. Evidence, Reasoning, and Modeling	SR	Identify which type of evidence would best support a claim that two organisms are different species.	D
31	Ecology	HS.LS.2.1	None	SR	Determine which evidence is most useful for identifying a mutualistic relationship between two organisms.	D
32	Molecules to Organisms	HS.LS.1.2	C. Evidence, Reasoning, and Modeling	SR	Complete a model to show a pathway in the nervous system.	*see page 8*
33	Molecules to Organisms	HS.LS.1.7	B. Mathematics and Data	SR	Analyze data to make a claim about the energy use of organisms.	*see page 8*
34	Molecules to Organisms	HS.LS.1.4	None	SR	Identify the cellular process that is responsible for tissue growth and repair.	D
35	Ecology	HS.LS.2.1	C. Evidence, Reasoning, and Modeling	SR	Explain how the carrying capacity of a population can be affected by a certain biotic factor.	A
36	Ecology	HS.LS.2.4	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Identify the trophic level of an organism in a food web and analyze the food web to determine how a decrease in one population would affect other populations in the ecosystem.	C;B
37	Evolution	HS.LS.4.2	None	CR 3 pt.	Describe how genetic diversity of a population changed as the population decreased and explain how a trait can become more common in a population over time.	
38	Molecules to Organisms	HS.LS.1.1	A. Investigations and Questioning	SR	Identify a question that could be asked to determine whether a substance is an enzyme.	D
39	Heredity	HS.LS.3.2	C. Evidence, Reasoning, and Modeling	SR	Explain the importance of meiosis for a certain type of plant.	B
40	Evolution	HS.LS.4.4	A. Investigations and Questioning	SR	Analyze research data to determine whether an infection is bacterial or viral.	A
41	Evolution	HS.LS.4.5	C. Evidence, Reasoning, and Modeling	SR 2 pt.	Determine the best evidence that two populations are geographically isolated from each other and determine what evidence could be used to show that reproductive isolation occurred.	D;C
42	Ecology	HS.LS.2.7	None	CR 4 pt.	Explain how an organism can become an invasive species over a large area and explain how damage caused by an invasive species can affect other species in the ecosystem.	

* STE 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 5 through 8 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 #2: Technology-Enhanced Item

The karyotype diagram shows the [diploid ▾] number of chromosomes

that would be found in [body cells ▾] of a human female.

Correct Answer for CBT Item #3: Technology-Enhanced Item
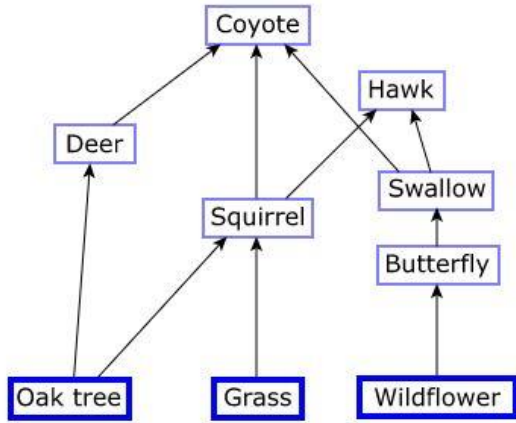
Correct Answer for CBT Item #4: Technology-Enhanced Item

The [thymine (T) ▾] nucleotides in the mRNA transcript should be replaced

with [uracil (U) ▾] nucleotides.

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

Phases of the Cell Cycle

Interphase	A cell develops and grows.
Mitosis	Chromosomes of a cell separate.
Cytokinesis	Cell membranes form to divide a cell into two cells.

Correct Answer for CBT Item #8: Technology-Enhanced Item

Carbon Cycle Process	Releases Carbon	Stores Carbon
photosynthesis	○	●
cellular respiration	●	○
combustion	●	○

Correct Answer for CBT Item #22: Technology-Enhanced Item

Diffusion is a process that moves oxygen [across cell membranes ▾] to allow

oxygen [to be used by ▾] cells to help maintain homeostasis.

Correct Answer for CBT Item #23: Technology-Enhanced Item

The diagram supports the claim that crossing over [increases ▾] genetic variability because the

homologous chromosomes [exchange genetic material ▾] during crossing over.

Correct Answer for CBT Item #24: Technology-Enhanced Item

mechanical breakdown by chewing and chemical breakdown by saliva

mechanical mixing and chemical breakdown by enzymes and acid

absorption of water from undigested materials

absorption of nutrients
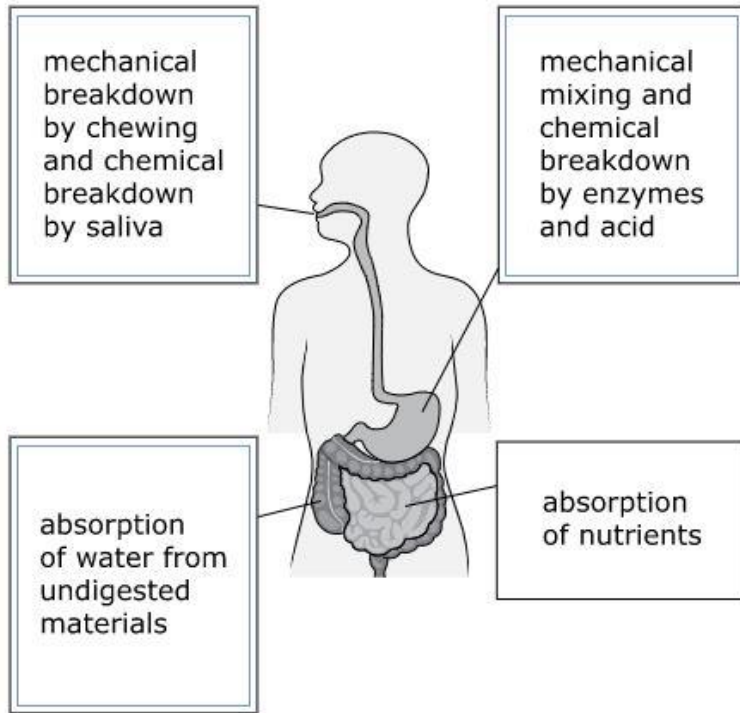
Correct Answer for CBT Item #25: Technology-Enhanced Item

Part A

Select from the drop-down menus to correctly complete the sentences.

These results show that, between 2006 and 2009, the amount of CYP1A protein in ducks exposed to oil was [higher than ▾] the amount of CYP1A protein in ducks not exposed to oil.

In 2014, the amount of CYP1A protein in ducks exposed to oil was [lower than ▾] the amount in 2006. This evidence suggests that the amount of oil in the environment most likely [decreased ▾] from 2006 to 2014.
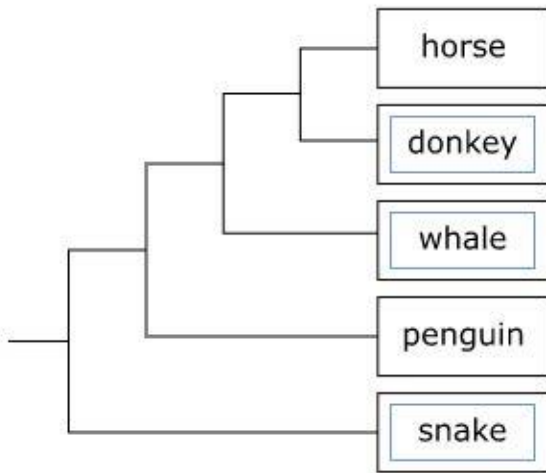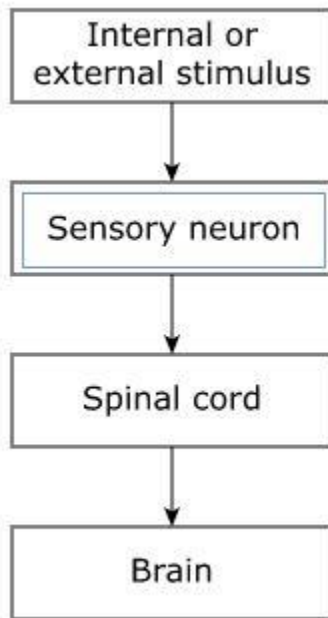
Part B

The *CYP1A* gene codes for the CYP1A protein.

Select from the drop-down menus to correctly complete the sentence.

After the *CYP1A* gene is [transcribed ▾] into mRNA, the mRNA is [translated ▾] to produce CYP1A protein.

Correct Answer for CBT Item #28: Technology-Enhanced Item

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

Correct Answer for CBT Item #33: Technology-Enhanced Item

During the hibernation period, | infected bats ▾ | use more energy than

| healthy bats ▾ | . They use more energy because they

| have more periods of activity ▾ | .

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