
XII. Biology, Grade 10

Grade 10 Biology Pilot Test

The spring 2004 Grade 10 MCAS Biology Test was based on learning standards in the Biology content strand of the Massachusetts *Science and Technology/Engineering Curriculum Framework* (2001). These learning standards appear on pages 49–51 of the *Framework*.

The *Science and Technology/Engineering Curriculum Framework* is available on the Department website at www.doe.mass.edu/frameworks/scitech/2001/0501.pdf.

Because the Grade 10 Biology Test was administered as a pilot test this year, the reporting of results is limited to *Test Item Analysis Reports*. No scaled score or performance level results are available.

Test Sessions and Content Overview

The Grade 10 Biology Test contained two separate test sessions. Each session included multiple-choice and open-response questions. Common test items are shown on the following pages as they appeared in test booklets.

Reference Materials and Tools

The Grade 10 Biology Test was designed to be taken without the aid of a calculator. Students were allowed to have calculators with them during testing, but calculators were not needed to answer questions.

No other reference tools or materials were allowed, with the exception of bilingual word-to-word dictionaries used by limited English proficient students.

Cross-Reference Information

The table at the conclusion of this chapter indicates the Framework learning standard that each item assesses. The correct answers for multiple-choice questions are also displayed in the table.

HOW TO ANSWER OPEN-RESPONSE QUESTIONS

Be sure to

- read all parts of each question carefully.
- make each response as clear, complete, and accurate as you can.
- check your answers.

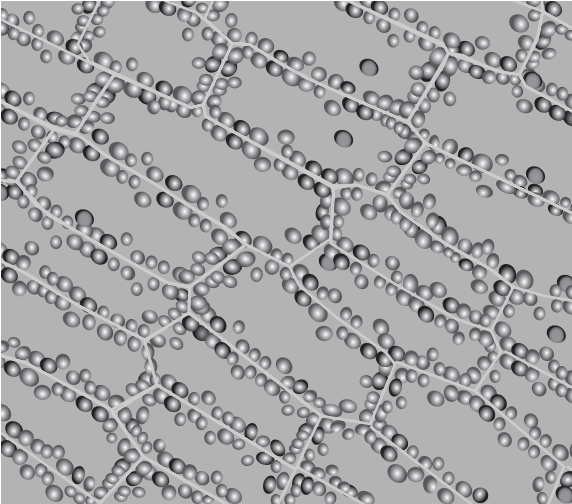
Biology

SESSION 1

DIRECTIONS

This session contains ten multiple-choice questions and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet. You may work out solutions to multiple-choice questions in the test booklet.

- 1 A biology student observed the cells shown below under a microscope.



These cells **most likely** came from

- A. an animal.
- B. an archaebacterium.
- C. a fungus.
- D. a plant.

- 2 Which of the following is a primary function of carbohydrates?
- A. storage of energy
 - B. transmission of genetic material
 - C. acceleration of chemical reactions
 - D. transport of molecules across membranes

3 Genetic information usually flows in one specific direction. Which of the following **best** represents this flow?

- A. DNA → Protein → RNA
- B. Protein → RNA → DNA
- C. RNA → Protein → DNA
- D. DNA → RNA → Protein

4 Legumes, such as clover and alfalfa, have nodules on their roots that contain nitrogen-fixing bacteria. These bacteria convert nitrogen gas from the atmosphere into nitrates.

Which of the following best accounts for the presence of nitrogen-fixing bacteria in legume root nodules?

- A. Nitrates are a food source for earthworms.
- B. Plants can use nitrates, but not nitrogen gas.
- C. Nitrates are one of the reactants in photosynthesis.
- D. Nitrogen gas is toxic to most plants, but nitrates are nontoxic.

5 The following statements all apply to **one** element:

- used by plants in photosynthesis
- found in carbohydrates, proteins, and lipids
- recycled by decay and burning
- required element in all organic molecules

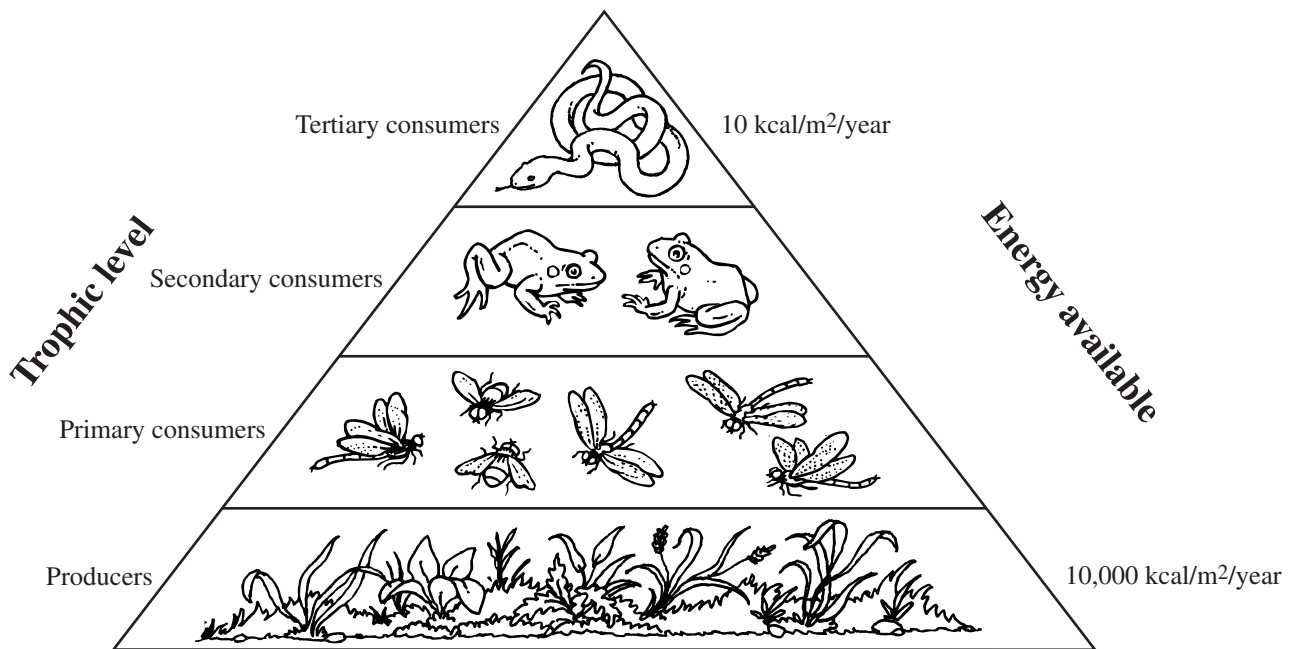
What is this element?

- A. carbon
- B. nitrogen
- C. phosphorus
- D. sulfur

6 Which of the following is an example of codominance in genetic traits?

- A. A tall pea plant and a short pea plant produce tall pea plants.
- B. An orange cat and a black cat produce an orange-and-black kitten.
- C. A blue-eyed man and a brown-eyed woman produce a blue-eyed child.
- D. A color-blind woman and a man with normal vision produce a color-blind son.

- 7 The diagram below shows an energy pyramid.



Approximately how much energy is available to the secondary consumers in this energy pyramid?

- A. 10 kcal/m²/year
- B. 100 kcal/m²/year
- C. 1,000 kcal/m²/year
- D. 5,000 kcal/m²/year

Question 8 is an open-response question.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 8 in the space provided in your Student Answer Booklet.

8

The wrasse and the blenny are two small fishes that resemble each other. The wrasse eats parasites attached to the skin of other fish. Even some large predatory fish allow the wrasse to approach unharmed and eat parasites. Predatory fish also allow the blenny to approach. However, instead of eating parasites, the blenny attacks the predatory fish.

- a. Is there evolutionary pressure for the blenny to look like the wrasse? Explain what causes the presence or absence of this evolutionary pressure. Be sure to use specific details in your answer.

- b. Is there evolutionary pressure for the wrasse to look like the blenny? Explain what causes the presence or absence of this evolutionary pressure. Be sure to use specific details in your answer.

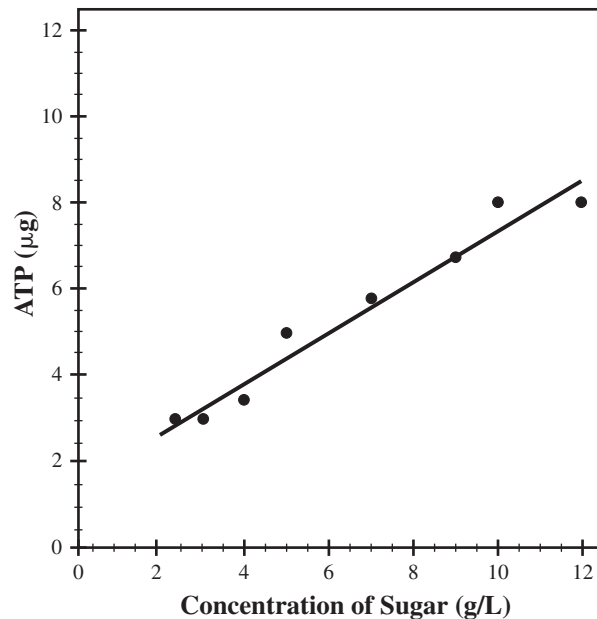
Mark your answers to multiple-choice questions 9 through 11 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet, but you may work out solutions to multiple-choice questions in the test booklet.

9 A cell has a defect that results in the loss of its ability to regulate the passage of water, food, and wastes into and out of the cell. In which of the following cell structures is this defect **most likely** to be located?

- A. ribosomes
- B. chloroplasts
- C. cell membrane
- D. endoplasmic reticulum

- 10 The graph below represents data gathered during an experiment on cellular respiration.

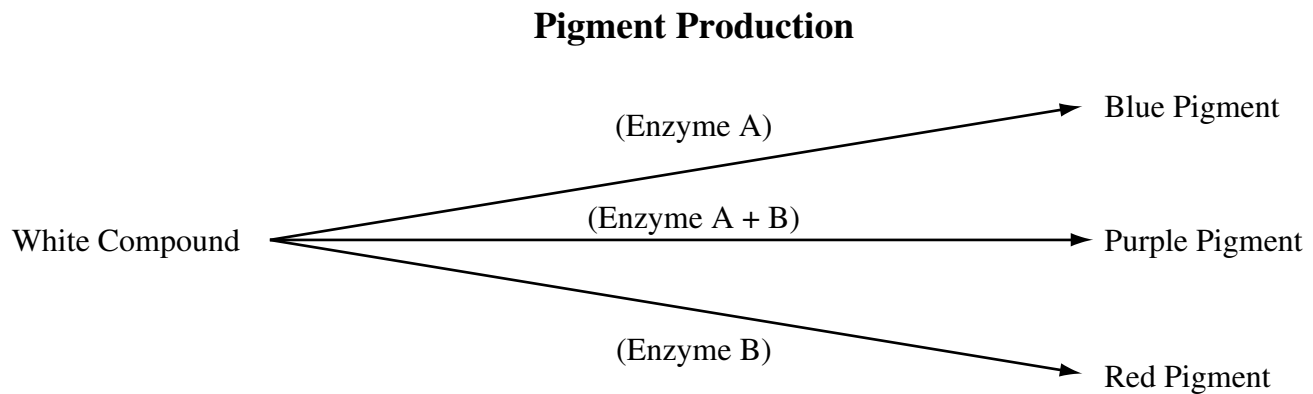
Effect of Sugar on ATP Production in Muscle Cells



Which of the following conclusions is **best** supported by data from this graph?

- A. ATP production is independent of sugar availability.
- B. The amount of cellular respiration is constant in muscle cells.
- C. ATP is only produced when sugar concentrations are above 4 g/L.
- D. The amount of cellular respiration increases as sugar concentration increases.

- 11 The diagram below shows a biochemical pathway.



In one species of plant, the flower petals are normally purple if both enzyme A and enzyme B are produced. If a mutation occurred that stopped production of enzyme A, but **not** enzyme B, what color flower petals would be produced?

- A. red
- B. blue
- C. white
- D. purple

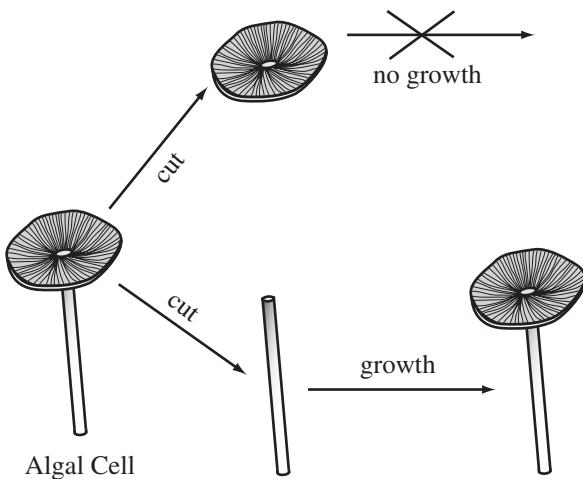
Biology

SESSION 2

DIRECTIONS

This session contains ten multiple-choice questions and one open-response question. Mark your answers to these questions in the spaces provided in your Student Answer Booklet. You may work out solutions to multiple-choice questions in the test booklet.

- 12 The algal cell pictured below is a single-celled organism.

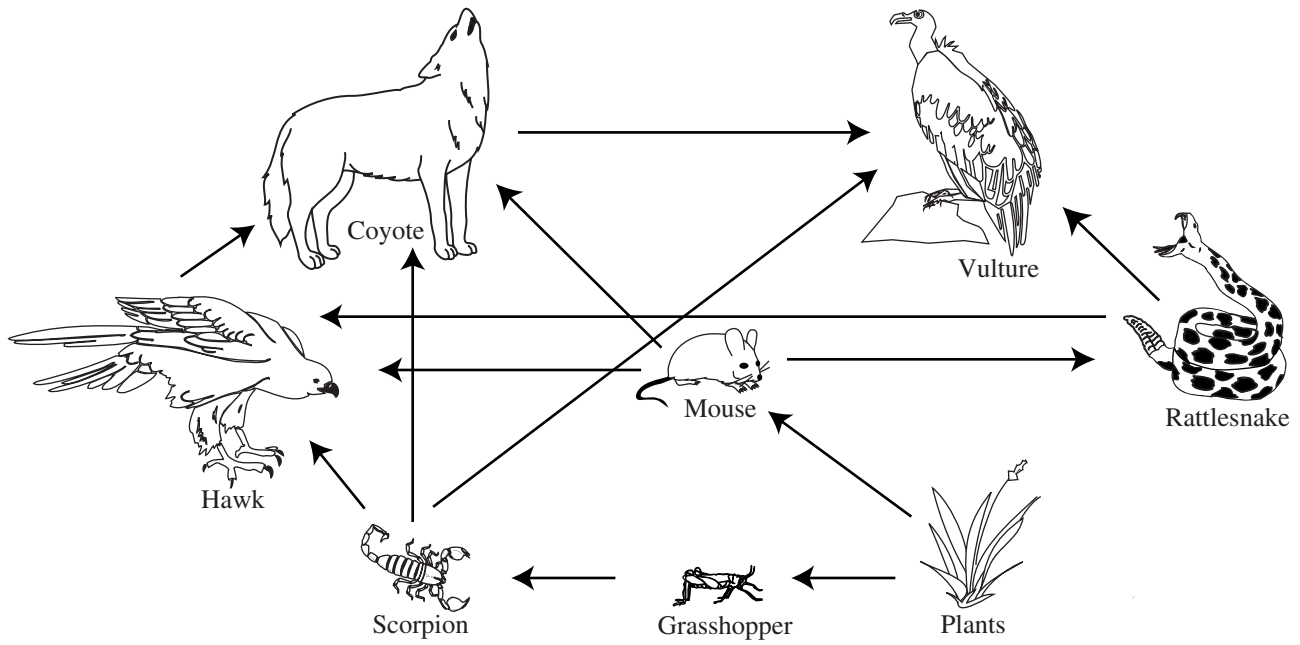


When the algal cell is cut in two as shown, the bottom part can grow into a complete cell, but the top part cannot. What conclusion does this support?

- A. The ribosomes are found in the top of the cell.
- B. The nucleus is found in the bottom of the cell.
- C. The top of the cell contains most of its chromosomes.
- D. The bottom of the cell contains most of its cytoplasm.

- 13 More than 1.5 million species of animals have been described, yet all of them have DNA that is made of the same building blocks. This is evidence that all animals have
- A. a common ancestor.
 - B. identical fossils.
 - C. similar appearances.
 - D. the exact same DNA sequences.

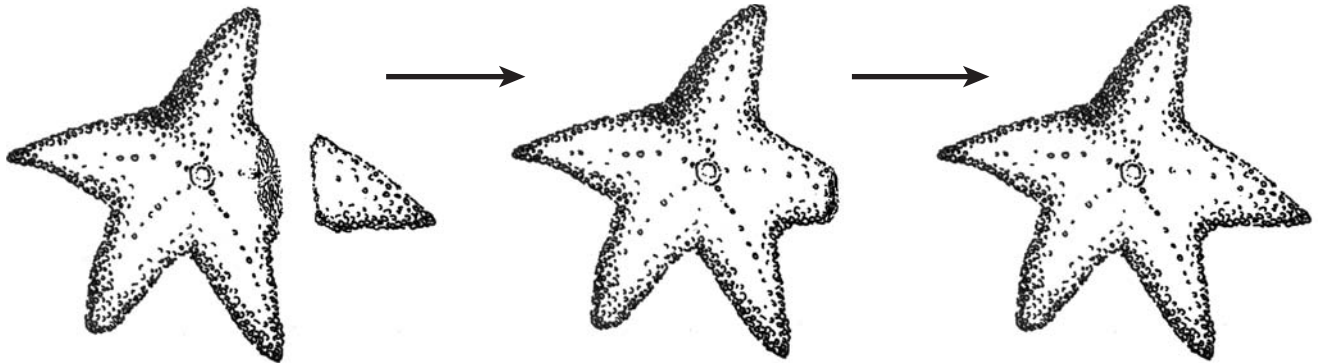
14 The diagram below shows some of the feeding relationships in a desert food web.



Which of the following trophic levels is **not** shown in this diagram?

- A. producers
- B. decomposers
- C. primary consumers
- D. secondary consumers

- 15 The diagram below shows a sea star in various stages of regeneration.



What cellular process is **directly** responsible for this regeneration?

- A. meiosis
 - B. mitosis
 - C. transpiration
 - D. respiration
-
- 16 An amoeba, an oak tree, a squirrel, and mildew are all classified in the same
- A. domain.
 - B. kingdom.
 - C. genus.
 - D. species.
- 17 Many aquatic birds secrete waxy organic substances that repel water. The birds use these substances to coat their feathers. An analysis of these substances would reveal that they are composed mostly of
- A. lipids.
 - B. proteins.
 - C. carbohydrates.
 - D. nucleic acids.

Question 18 is an open-response question.

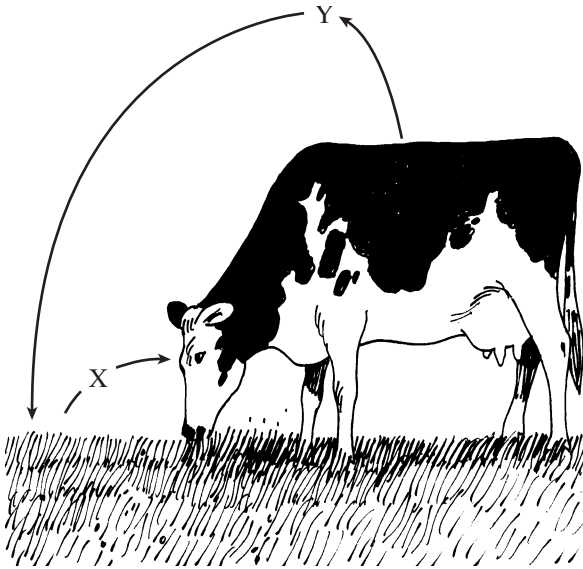
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 18 in the space provided in your Student Answer Booklet.

- 18** A Punnett square is a tool used to predict the outcome of a genetic cross.
- Make a Punnett square for the cross of a father heterozygous for short fingers and a mother homozygous dominant for short fingers. Use **B** to indicate the allele for short fingers and **b** to indicate the allele for long fingers.
 - Identify the expected percentages of the phenotypes in the F_1 generation for the cross in part a.
 - Make a Punnett square for the cross of a tall father who is homozygous dominant for height and a short mother who is homozygous recessive for height. Use **T** to indicate the allele for tall and **t** to indicate the allele for short.
 - Identify the expected percentages of the phenotypes in the F_1 generation for the cross in part c.

Mark your answers to multiple-choice questions 19 through 22 in the spaces provided in your Student Answer Booklet. Do not write your answers in this test booklet, but you may work out solutions to multiple-choice questions in the test booklet.

- 19 The illustration below shows part of the carbon cycle.



At position Y, carbon is **most likely** to be in which of the following forms?

- A. protein
- B. carbon solid
- C. carbohydrate
- D. carbon dioxide

- 20 A mutation that prevents a maple tree from efficiently taking gases from the air would **most directly** affect which of the following processes?

- A. reproduction
- B. photosynthesis
- C. water uptake
- D. DNA replication

- 21 Carbon atoms in organic molecules **most commonly** bond to atoms of hydrogen, oxygen, and
- A. calcium.
 - B. magnesium.
 - C. nitrogen.
 - D. sodium.

- 22 A human zygote, like most other human cells, contains 46 chromosomes. How many chromosomes does a zygote receive from the mother?
- A. 0
 - B. 23
 - C. 46
 - D. 92

Grade 10 Biology
Spring 2004 Released Items:
Standards and Correct Answers

Item No.	Page No.	Standard	Correct Answer (MC)*
1	277	2.3	D
2	277	1.3	A
3	278	3.1	D
4	278	6.1	B
5	278	1.1	A
6	278	3.5	B
7	279	6.2	B
8	280	5.2	
9	281	2.5	C
10	282	2.8	D
11	283	1.5	A
12	284	2.1	B
13	284	5.1	A
14	285	6.2	B
15	286	2.10	B
16	286	5.3	A
17	286	1.3	A
18	287	3.7	
19	288	6.1	D
20	288	2.6	B
21	289	1.2	C
22	289	3.8	B

* Answers are provided here for multiple-choice items only. Sample responses and scoring guidelines for open-response items, which are indicated by shaded cells, will be posted to the Department's website later this year.