XVIII. Biology, High School

High School Biology Test

The spring 2016 high school Biology test was based on learning standards in the Biology content strand of the *Massachusetts Science and Technology/Engineering Curriculum Framework* (2006). These learning standards appear on pages 54–58 of the *Framework*, which is available on the Department website at www.doe.mass.edu/frameworks/current.html.

Biology test results are reported under the following five MCAS reporting categories:

- Biochemistry and Cell Biology
- Genetics
- Anatomy and Physiology
- Ecology
- Evolution and Biodiversity

The table at the conclusion of this chapter indicates each item's reporting category and the framework learning standard it assesses. The correct answers for multiple-choice questions are also displayed in the table.

Test Sessions

The high school Biology test included two separate test sessions, which were administered on consecutive days. Each session included multiple-choice and open-response questions.

Reference Materials and Tools

The high school 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.

During both Biology test sessions, the use of bilingual word-to-word dictionaries was allowed for current and former English language learner students only. No other reference tools or materials were allowed.

Biology

Session 1

DIRECTIONS

This session contains twenty-one multiple-choice questions and two open-response questions. 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 Which of the following are mainly cycled through the processes of photosynthesis and cellular respiration?

A. carbon and sulfur

B. carbon and oxygen

C. nitrogen and sulfur

D. nitrogen and oxygen

2 A mutation caused a phenotypic change in an organism's offspring. The mutation most likely occurred in which type of cell from the parent?

A. blood cell

B. gamete

C. neuron

D. skin cell

3 Black bears can be found in several areas in Texas and Mexico. The size of one of these bear populations decreased when some individuals from the population moved to another area.

Based on this information, what caused a decrease in the size of this bear population?

A. emigration

B. extinction

C. natural selection

D. speciation

4 A company provides genetic analysis to people who want to learn more about their ancestors. One couple sent the company samples of their biological children's cells as well as samples of their own cells for testing.

Which of the following describes how the genetic material in the chromosomes of the children will compare to the genetic material in the chromosomes of the parents?

A. Each child will have all of the mother's genetic material and all of the father's genetic material.

B. The daughters will have exactly the same genetic material as the mother, and the sons will have exactly the same genetic material as the father.

C. About half of the genetic material in each child will be the same as the mother's, and about half of the genetic material will be the same as the father's.

D. Half of the children will have exactly the same genetic material as the mother, and half of the children will have exactly the same genetic material as the father.

5 A scientist concludes that two organisms belong to the same species within the class Mammalia. Which of the following observations **most likely** led the scientist to conclude that the organisms are the same species?

A. The organisms move in the same way.

B. The organisms live in the same habitat.

C. The organisms are nocturnal and carnivorous.

D. The organisms mate and produce fertile offspring.

6 In betta fish, alleles for color are incompletely dominant. Green fish have genotype **CC**, dark blue fish have genotype **cc**, and royal blue fish have genotype **Cc**.

Two royal blue betta fish are crossed. What percentage of the offspring is expected to be green?

A. 0%

B. 25%

C. 50%

D. 75%

7 A cell from an organism has the structures listed below.

- nucleus
- mitochondria
- cell wall
- chloroplasts

The organism is most likely classified as which of the following?

A. animal

B. bacterium

C. fungus

D. plant

The following section focuses on cholesterol.

Read the information below and use it to answer the four multiple-choice questions and one open-response question that follow.

Cholesterol is a waxy, organic substance found in body cells and in blood. The human body uses cholesterol to make cell membranes, vitamin D, hormones, and bile (a liver product). There are two major types of cholesterol, both produced by the liver.

- LDL cholesterol is called "bad cholesterol." Excess amounts of LDL cholesterol in the blood mix with other substances and stick to the walls of arteries. The arteries become narrow and lose flexibility as these cholesterol layers build up and harden (a condition called atherosclerosis).
- HDL cholesterol is called "good cholesterol." HDL cholesterol can help transport LDL cholesterol out of the blood to be processed and eliminated from the body.

Total cholesterol levels in the body can be affected by genetics and diet. For example, a person may inherit genes that result in low cholesterol or high cholesterol; or a person may eat large amounts of animal products, such as meat, dairy, and eggs, that are high in cholesterol.

Exercise, medications, or changes in diet may help lower LDL blood cholesterol levels in humans. Increasing the amount of fiber in a diet, for example, is one specific action that may lower LDL cholesterol levels.

Mark your answers to multiple-choice questions 8 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.

8 What is the typical path that dietary cholesterol takes through the digestive system, from the mouth to where it is absorbed into the bloodstream?

A. mouth → esophagus → pharynx → small intestine → stomach

B. mouth → pharynx → esophagus → small intestine → stomach

C. mouth → pharynx → esophagus → stomach → small intestine

D. mouth → esophagus → stomach → pharynx → small intestine

9 Cholesterol belongs to which category of organic molecules?

A. carbohydrates

B. lipids

C. nucleic acids

D. proteins

10 Which of the following changes will most likely **decrease** the risk of atherosclerosis?

A. decreasing the permeability of cells' plasma membranes

B. slowing the rate at which vitamins and hormones are produced

C. raising the amount of HDL cholesterol released into blood

D. increasing the rate at which LDL cholesterol is produced by the liver

11 Besides producing cholesterol and bile, which of the following is a function of the liver?

A. digesting fiber

B. making red blood cells

C. removing toxins from blood

D. storing stomach contents for digestion

Question 12 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 12 in the space provided in your Student Answer Booklet.

12 Blood carries oxygen to body cells.

a. Identify the process in body cells that directly requires oxygen **and** identify the structure in blood that transports oxygen to body cells.

Individuals monitor their total cholesterol levels to try to assess their risk of atherosclerosis.

b. Describe the effect of atherosclerosis on the amount of oxygen supplied to body cells. Explain your answer.

Additional health problems such as heart attacks and strokes cause cells to become damaged or die due to lack of oxygen.

c. Explain why cells die if they cannot perform the process you identified in part (a) because they do not receive oxygen for an extended period of time.

Mark your answers to multiple-choice questions 13 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.

13 Which of the following statements best describes the reproduction of both viruses and cells?

A. Viruses and cells use mitosis to reproduce.
B. Viruses and cells must have a host to reproduce.
C. Viruses and cells must activate polar bodies to reproduce.
D. Viruses and cells need copies of their genetic material to reproduce.

14 Because of sport hunting and the draining of marshlands, the size of the whooping crane population reached a low of 16 individuals in 1940. Since then, conservation efforts have been put in place to increase the whooping crane population size.

Which of the following actions would most likely increase the size of the whooping crane population with the **least** impact on the ecosystem?

A. introducing new insect species for whooping cranes to eat
B. eliminating all wild predators in the whooping crane's habitat
C. establishing protected areas for whooping crane breeding and migration
D. counting whooping crane populations by tagging and releasing individual birds

15 Tiger beetles chase small spiders, which they catch in their strong jaws and then eat. What is the ecological relationship between tiger beetles and spiders?

A. competition
B. mutualism
C. parasite-host
D. predator-prey

16 A population of grasshoppers increased in size over a five-year period. Which of the following **best** explains this increase?

A. The death rate was higher than the birth rate, and the immigration rate was equal to the emigration rate.
B. The emigration rate was higher than the birth rate, and the immigration rate was equal to the death rate.
C. The immigration rate was higher than the death rate, and the emigration rate was equal to the birth rate.
D. The emigration rate was higher than the immigration rate, and the birth rate was equal to the death rate.

17 Erwin Chargaff is considered one of the pioneering scientists in the field of molecular biology. In one of his studies, Chargaff observed that a sample of human DNA contained approximately 30% adenine and 20% guanine.

Based on DNA structure, what are the expected percentages of the other nitrogenous bases in the sample?

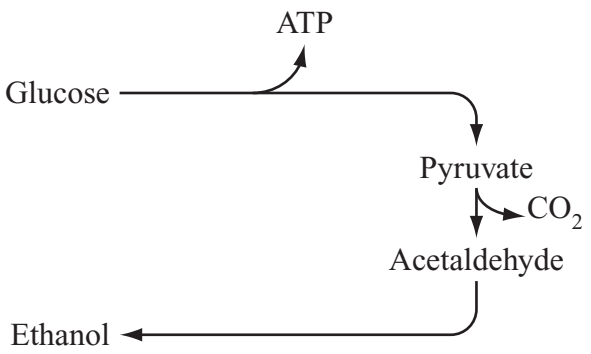
A. 10% thymine, 40% cytosine

B. 20% thymine, 30% cytosine

C. 30% thymine, 20% cytosine

D. 40% thymine, 10% cytosine

18 The diagram below summarizes a series of chemical reactions that occur in cells.



Which product of these reactions directly supplies energy to cells?

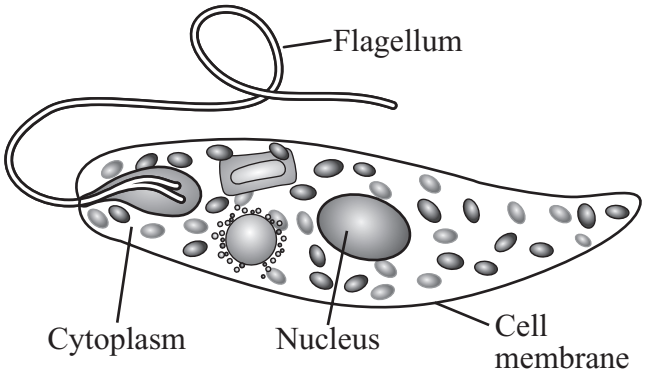
A. ATP

B. pyruvate

C. CO_2

D. ethanol

19 The diagram below represents a single-celled organism.



Which labeled part identifies this single-celled organism as eukaryotic?

A. cell membrane

B. cytoplasm

C. flagellum

D. nucleus

20 Iodine is moved against its concentration gradient into the cells of the thyroid gland. Iodine is used by the thyroid cells to produce a hormone.

Which of the following processes moves iodine into the thyroid cells?

A. active transport
B. cellular respiration
C. diffusion
D. osmosis

21 Thousands of years ago, the jaws and teeth of jaguars were more varied in size than they are today. During a period of climate change about 11,000 years ago, jaguars faced a shortage of food. There were fewer mammals to eat, so the jaguars had to eat shelled reptiles. The jaguars with the largest jaws and teeth could most easily eat the shelled reptiles.

Which of the following statements **best** explains why large jaws and teeth are common characteristics in jaguars today?

A. Jaguars with the smallest jaws and teeth died out completely.
B. Jaguars with the smallest jaws and teeth were not ever able to mate.
C. Jaguars with the largest jaws and teeth survived and reproduced more successfully than other jaguars.
D. Jaguars with the largest jaws and teeth strengthened them by using them more frequently than other jaguars.

22 A gene that affects hair length in dogs has two alleles. The allele for short hair (**L**) is dominant to the allele for long hair (**l**). A cross of two short-haired dogs produces six short-haired and two long-haired offspring.

Which of the following best explains how the long-hair phenotype can appear in the offspring of two short-haired dogs?

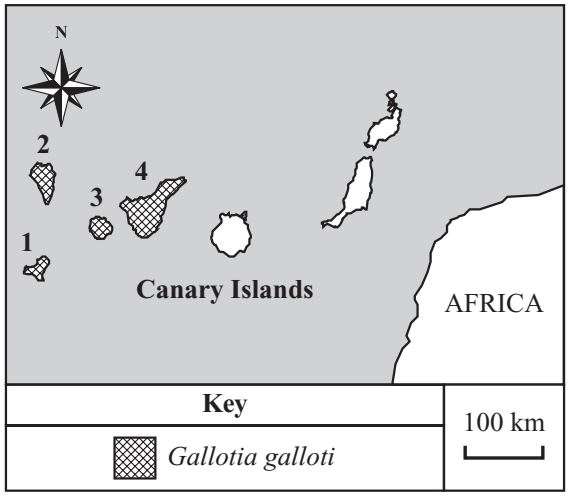
A. Only recessive alleles are inherited from homozygous parents.
B. Dominant alleles grow weaker as they are passed from parents to offspring.
C. Only the parent with a dominant allele can pass that allele to offspring in sexual reproduction.
D. A heterozygous parent has an equal chance of passing either the dominant allele or the recessive allele to offspring.

Question 23 is an open-response question.

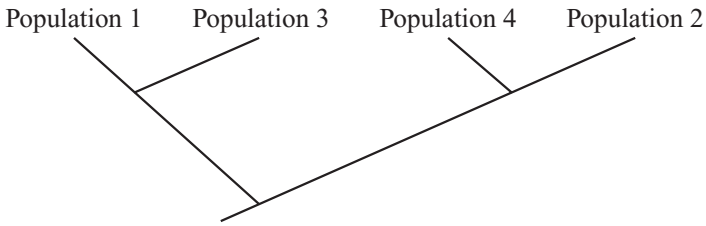
- **BE SURE TO ANSWER AND LABEL ALL PARTS OF THE QUESTION.**
- **Show all your work (diagrams, tables, or computations) in your Student Answer Booklet.**
- **If you do the work in your head, explain in writing how you did the work.**

Write your answer to question 23 in the space provided in your Student Answer Booklet.

23 The lizard *Gallotia galloti* lives on four of the Canary Islands, as shown on the map below. Each island has its own population of lizards, numbered 1 to 4 on the map.



Scientists have sequenced and compared DNA from lizards in each population. The cladogram below shows one hypothesis regarding how the lizard populations are related.



a. The DNA sequences of individuals from population 3 are probably **most** similar to the DNA sequences of individuals from which other population (1, 2, or 4)? Explain your answer.

Scientists also sometimes analyze behaviors when investigating relatedness among organisms.

b. Besides DNA and behavior, identify one type of evidence scientists could have used to investigate relatedness among the four lizard populations.

Scientists predict that, much like the finches on the Galápagos Islands, the four populations of *Gallotia galloti* will become separate species over time.

c. Describe the roles of both the environment **and** geographic isolation in the lizards' becoming different species.

Biology
SESSION 2

DIRECTIONS

This session contains nineteen multiple-choice questions and three open-response questions. 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.

24 The brush mouse and the northwestern deermouse are both classified in the genus *Peromyscus*. Which of the following conclusions can be made from this information?

A. The two types of mice live in the same habitat.

B. The two types of mice have the same fur color.

C. The two types of mice are closely related to each other.

D. The two types of mice can successfully interbreed with each other.

25 Some diseases decrease the activity of certain enzymes in the mitochondria of cells. Which of the following is the **most direct** result of this decreased enzyme activity?

A. The cells are not able to divide by mitosis.

B. The cells are not able to move water by diffusion.

C. The cells produce less ATP by cellular respiration.

D. The cells produce fewer sugars by photosynthesis.

26 The protein XIAP is involved in the immune response of many organisms. The table below includes the amino acid sequences of one section of XIAP in humans and four other organisms.

Organism	Amino Acid Sequence
human	G D Q V Q C F C C G G K L K N W E
organism 1	D D Q V Q A F C C G G K L K N W E
organism 2	G D Q V Q C F C C G G K L K N W E
organism 3	D D Q V Q C F C C G G K L K N W E
organism 4	D D N V Q C F C C G G G L S G W E

Each letter in the sequences represents a particular amino acid. For example, G represents glycine and D represents aspartic acid.

Based on the amino acid sequences in the table, which two organisms have an XIAP gene sequence **most** similar to that of humans?

A. organisms 1 and 2

B. organisms 1 and 4

C. organisms 2 and 3

D. organisms 3 and 4

27 In Japanese quail, the allele for curly feathers (**c**) is recessive to the allele for smooth feathers (**C**). Which of the following best describes the offspring of quail parents that each have the genotype **Cc**?

A. Most offspring are expected to have curly feathers.

B. Most offspring are expected to have smooth feathers.

C. All offspring are expected to have curly feathers.

D. All offspring are expected to have smooth feathers.

28 Which of the following relationships is the **best** example of mutualism?

A. a tick feeding on a deer

B. a coyote killing and eating a rabbit

C. a bee eating nectar and pollinating flowers

D. a parent tree blocking sunlight from reaching a seedling tree

29 The common marmoset is a small primate. A typical egg cell of a female marmoset contains 23 chromosomes.

How many chromosomes does a typical sperm cell of a male marmoset contain?

A. 12 chromosomes

B. 23 chromosomes

C. 46 chromosomes

D. 92 chromosomes

30 The creosote bush grows in the deserts of the southwestern United States. A common trait of the plant is its ability to produce poisons that keep predators and competing plants away.

This trait became common because, compared with individual plants lacking poisons, individual plants with poisons were better able to do which of the following?

A. survive and reproduce
B. store nectar and pollen
C. store water in their stems
D. interbreed with other species

31 Which of the following must occur before mitosis can begin?

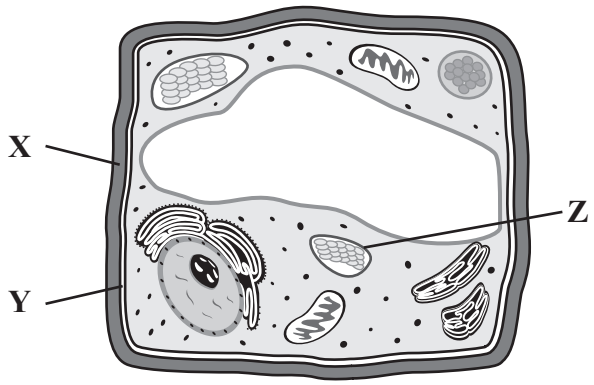
A. DNA must be replicated in the nucleus.
B. RNA must move to the center of the nucleus.
C. Chromosomes must attach to the cell membrane.
D. Ribosomes must move to opposite sides of the cell.

Question 32 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 32 in the space provided in your Student Answer Booklet.

32 The diagram below represents a plant cell with three structures labeled X, Y, and Z.



Plant cells and fungal cells have many of the same types of organelles. Structures X and Y are found in both plant cells and fungal cells. Structure Z is found in plant cells, but not in fungal cells.

a. Identify structure Y **and** describe its main function.

b. Identify structure Z **and** explain how plants use this structure to survive.

c. Explain how fungi can survive without structure Z.

Mark your answers to multiple-choice questions 33 through 43 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.

33 Human HLA genes have as many as 100 different alleles per gene. Which of the following terms **best** describes the inheritance pattern for each HLA gene?

A. codominant
B. linked gene
C. multiple allele
D. recessive

34 Skin cells and liver cells contain different sets of enzymes. Which of the following conclusions can be made based on this information?

A. Skin cells and liver cells have different numbers of mitochondria.
B. Skin cells and liver cells can perform different chemical reactions.
C. Skin cells and liver cells have different cell membrane compositions.
D. Skin cells and liver cells can contain different numbers of chromosomes.

35 In Australia, some native bugs eat the large fruit of an invasive plant by making a hole in the fruit's thick skin with their mouthparts. The table below shows data that scientists collected about the bugs before and after the invasive plants were introduced.

Bug Characteristic	Before Invasive Plants	After Invasive Plants
average length of mouthparts (female)	6.81 mm	7.41 mm
average length of mouthparts (male)	6.08 mm	6.48 mm
average body length (female)	13.24 mm	13.65 mm
average body length (male)	11.63 mm	11.92 mm

Based on the information in the table, which of the following best explains why this bug population has changed since the introduction of the invasive plants?

A. The bugs are unable to feed on native fruits.

B. Bugs with shorter mouthparts have all died off.

C. Bugs with longer mouthparts have a survival advantage.

D. The bugs have started cross-breeding with a larger species.

36 Based on fossil evidence, scientists concluded that whales evolved from hoofed mammalian ancestors that lived on land. New evidence confirms this and suggests that among the hoofed mammals, the hippopotamus is the closest living relative of whales.

Which of the following was the **most likely** source of this new evidence?

A. comparisons of lifespans

B. comparisons of gene sequences

C. mapping of geographic distributions

D. calculation of population birth rates

37 The table below gives information about the genetics of white spotting in cats.

Genotype	Phenotype
SS	 Mostly white
Ss	 Partially white
ss	 Black

If a partially white cat mates with a black cat, what are the expected phenotypes of the kittens?

A. All the kittens will be black.

B. Half the kittens will be black, and half will be partially white.

C. Three-quarters of the kittens will be black, and one-quarter will be partially white.

D. Three-quarters of the kittens will be partially white, and one-quarter will be mostly white.

38 Some types of organic fertilizers are made from animal products such as bone. These fertilizers are added to soil to provide a source of nutrients for plants.

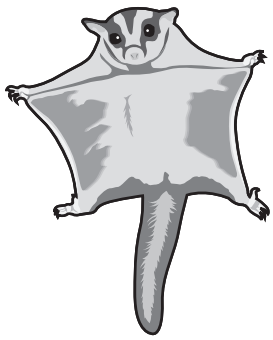
Which of the following elements is expected to be most abundant in organic fertilizers made from animal products?

A. copper
B. nickel
C. phosphorus
D. zinc

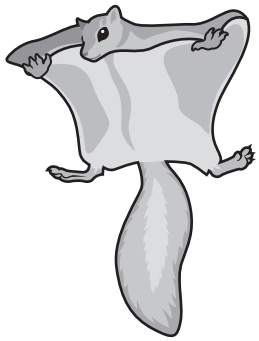
39 During the process of replication, a molecule of DNA unzips, forming two single strands. What makes up each individual strand of DNA?

A. paired adenine and uracil bases
B. paired thymine and guanine bases
C. sugar groups attached to individual amino acids
D. nitrogenous bases attached to a sugar-phosphate backbone

40 The illustrations below show a sugar glider and a flying squirrel.



Sugar Glider



Flying Squirrel

The sugar glider lives in Australia, and the flying squirrel lives in North America. The two species have many similar characteristics, including the ability to glide, but the sugar glider and the flying squirrel are not closely related species.

Which of the following statements explains why the sugar glider and the flying squirrel both have the ability to glide?

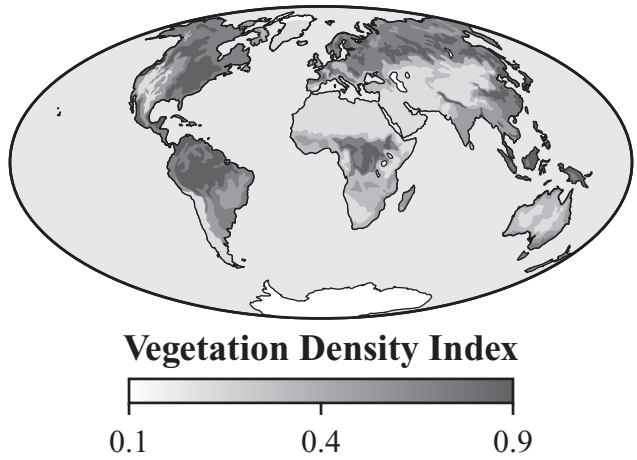
A. Both evolved at the same time in geologic history.

B. Both interbred and blended their gene pools in the past.

C. Both learned to glide by imitating the same kinds of bird species.

D. Both adapted to similar niches in which gliding increased their chances of survival.

41 Scientists use satellite data to produce images such as the one below, showing the density of plants across Earth's different land areas. Scientists study these images to determine how plant density changes during a year. They can then use this information to help predict carbon dioxide concentrations in the atmosphere in different locations and at different times of the year.



Which of the following **best** explains why scientists can predict carbon dioxide concentrations from plant density data?

A. Plants add carbon dioxide to the atmosphere during germination.

B. Plants add carbon dioxide to the atmosphere during transpiration.

C. Plants remove carbon dioxide from the atmosphere during photosynthesis.

D. Plants remove carbon dioxide from the atmosphere during cellular respiration.

42 Mountain pine beetles feed on the inner tissue of pine trees, eventually killing the trees. The beetles' habitat range does not extend as far north as the pine trees' habitat range extends. The beetles cannot tolerate very cold winter conditions.

Suppose the climate becomes warmer in the parts of the pine trees' habitat range where the beetles currently do not live. Which of the following statements describes the **most likely** outcome of this change?

A. The beetles will feed on other tree species.

B. Pine trees will become more resistant to the beetles.

C. The beetles will decrease in their current habitat range.

D. Pine trees will decrease in the northern part of their habitat range.

43 Dentists often use medicines called local anesthetics when removing a tooth so that the patient does not feel pain. Which of the following statements describes how local anesthetics block pain?

A. The anesthetic molecules attach to the lining of the mouth and constrict blood vessels there.

B. The anesthetic molecules bind to sensory neurons and prevent them from sending nerve impulses to the brain.

C. The anesthetic molecules bind to motor neurons and prevent them from sending nerve impulses to the mouth.

D. The anesthetic molecules enter the salivary glands and cause large amounts of saliva to be released in the mouth.

Questions 44 and 45 are open-response questions.

- **BE SURE TO ANSWER AND LABEL ALL PARTS OF EACH 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 44 in the space provided in your Student Answer Booklet.

44 A short mRNA sequence is shown in the box below.

5' **AUG-UCU-GAU-UGG-UAC** 3'

a. Determine the DNA sequence from which this mRNA sequence was transcribed.

b. Using the information in the table below, determine the amino acid sequence that is coded for by this mRNA sequence.

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

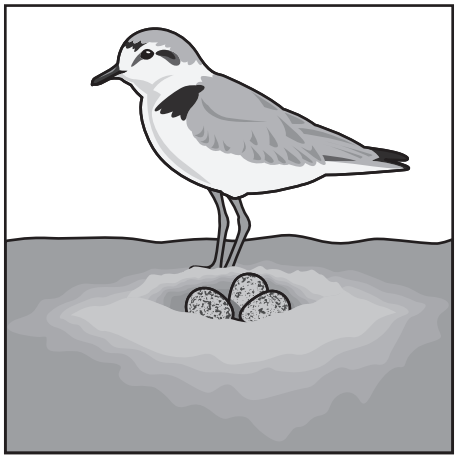
c. Using the information in the table, determine the first **four** amino acids coded for in **each** of the following situations. Be sure to label each situation.

- Situation 1: A mutation in the DNA sequence from part (a) changes the sixth base (read left to right) to cytosine (**C**).
- Situation 2: A mutation in the DNA sequence from part (a) deletes the sixth base.

d. In which situation from part (c) is the phenotype of the organism likely to change? Explain your answer.

Write your answer to question 45 in the space provided in your Student Answer Booklet.

45 The western snowy plover is a small bird that makes its nest in the sand on ocean and river shores. The snowy plover's breeding season is from March to September. A plover typically lays three eggs each year. If disturbed, it will often abandon its nest. A snowy plover and its nest are shown below.



a. Compare the birth rate (number of eggs hatched) to the death rate in a population of snowy plovers that is increasing in size.

In an initial population of 100 snowy plovers, there were 30 births and 20 deaths in one year.

b. Based only on the birth and death rates, identify the expected size of the snowy plover population at the end of the year.

At the end of the year, there were actually 80 snowy plovers in the population.

c. Assuming there were no additional births or deaths, explain why the actual population size differed from the expected population size.

Current efforts to conserve plover populations include building wire fences around their nests and making certain beaches off-limits to people during plover breeding season.

d. Explain why making certain beaches off-limits during plover breeding season is a more effective conservation method than building fences around plover nests.

High School Biology
Spring 2016 Released Items:
Reporting Categories, Standards, and Correct Answers*

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC)*
1	295	*Ecology*	6.4	B
2	295	*Genetics*	3.3	B
3	296	*Ecology*	6.1	A
4	296	*Anatomy and Physiology*	4.6	C
5	297	*Evolution and Biodiversity*	5.2	D
6	297	*Genetics*	3.6	B
7	297	*Biochemistry and Cell Biology*	2.3	D
8	299	*Anatomy and Physiology*	4.1	C
9	299	*Biochemistry and Cell Biology*	1.2	B
10	299	*Anatomy and Physiology*	4.8	C
11	299	*Anatomy and Physiology*	4.2	C
12	300	*Anatomy and Physiology*	4.2	
13	301	*Biochemistry and Cell Biology*	2.8	D
14	301	*Ecology*	6.2	C
15	301	*Ecology*	6.3	D
16	301	*Ecology*	6.1	C
17	302	*Genetics*	3.1	C
18	302	*Biochemistry and Cell Biology*	2.5	A
19	302	*Biochemistry and Cell Biology*	2.2	D
20	303	*Biochemistry and Cell Biology*	2.1	A
21	303	*Evolution and Biodiversity*	5.3	C
22	303	*Genetics*	3.5	D
23	304	*Evolution and Biodiversity*	5.2	
24	305	*Evolution and Biodiversity*	5.2	C
25	305	*Biochemistry and Cell Biology*	2.1	C
26	306	*Evolution and Biodiversity*	5.1	C
27	307	*Genetics*	3.6	B
28	307	*Ecology*	6.3	C
29	307	*Biochemistry and Cell Biology*	2.7	B
30	308	*Evolution and Biodiversity*	5.3	A
31	308	*Biochemistry and Cell Biology*	2.6	A
32	309	*Biochemistry and Cell Biology*	2.1	
33	310	*Genetics*	3.4	C
34	310	*Biochemistry and Cell Biology*	1.3	B
35	311	*Evolution and Biodiversity*	5.1	C

Item No.	Page No.	Reporting Category	Standard	Correct Answer (MC)*
36	312	*Evolution and Biodiversity*	5.1	B
37	312	*Genetics*	3.6	B
38	313	*Biochemistry and Cell Biology*	1.1	C
39	313	*Genetics*	3.1	D
40	314	*Evolution and Biodiversity*	5.1	D
41	314	*Ecology*	6.4	C
42	315	*Ecology*	6.2	D
43	315	*Anatomy and Physiology*	4.4	B
44	316	*Genetics*	3.3	
45	317	*Ecology*	6.1	

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