

The University of the State of New York  
REGENTS HIGH SCHOOL EXAMINATION

# LIVING ENVIRONMENT

**Monday**, January 26, 2015 — 9:15 a.m. to 12:15 p.m., only

Student Name \_\_\_\_\_

School Name \_\_\_\_\_

The possession or use of any communications device is strictly prohibited when taking this examination. If you have or use any communications device, no matter how briefly, your examination will be invalidated and no score will be calculated for you.

Print your name and the name of your school on the lines above.

A separate answer sheet for multiple-choice questions in Parts A, B-1, B-2, and D has been provided to you. Follow the instructions from the proctor for completing the student information on your answer sheet.

You are to answer all questions in all parts of this examination. Record your answers for all multiple-choice questions, including those in Parts B-2 and D, on the separate answer sheet. Record your answers for all open-ended questions directly in this examination booklet. All answers in this examination booklet should be written in pen, except for graphs and drawings, which should be done in pencil. You may use scrap paper to work out the answers to the questions, but be sure to record all your answers on the answer sheet or in this examination booklet as directed.

When you have completed the examination, you must sign the declaration printed on your separate answer sheet, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer sheet cannot be accepted if you fail to sign this declaration.

Notice...

A four-function or scientific calculator must be made available for you to use while taking this examination.

**DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.**

## Part A

Answer all questions in this part. [30]

*Directions (1–30):* For *each* statement or question, record on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

1 Which observation could lead to the conclusion that an object is nonliving?

- (1) It passes on hereditary information only through asexual reproduction.
- (2) It carries out synthesis.
- (3) It cannot perform metabolic processes.
- (4) It is composed of a cell, but does not have tissues.

2 Decomposers are necessary in a food chain because they

- (1) manufacture food by photosynthesis
- (2) return nutrients to the ecosystem
- (3) absorb energy from the Sun
- (4) produce organic nutrients

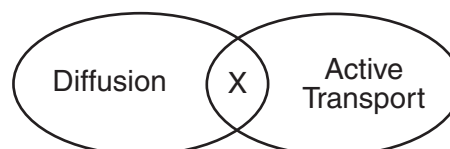
3 In early spring, many wildflowers begin to grow, produce flowers, and release seeds. The leaves of the wildflowers make food before the leaves of the trees in the area begin to develop. The early growth pattern of the wildflowers would likely result in

- (1) decreased competition for sunlight between the trees and the wildflowers
- (2) decreased competition for suitable temperature between the trees and the wildflowers
- (3) increased competition for space between the trees and the wildflowers
- (4) increased competition for oxygen between the trees and the wildflowers

4 Which sequence best represents increasing complexity?

- (1) tissues → cells → organelles → organs
- (2) cells → organelles → organs → organism
- (3) organelles → cells → tissues → organs
- (4) organism → cells → tissues → organelles

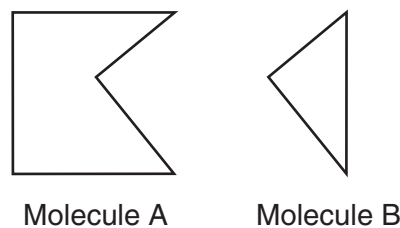
5 The diagram below represents two processes that occur in organisms. A characteristic represented by *X* is common to both of these processes.



A characteristic that the two processes have in common is that each process

- (1) uses ATP
- (2) requires enzymes
- (3) uses oxygen
- (4) moves molecules

6 The molecules represented in the diagram below can interact to cause a biochemical process to occur.



Molecule *A* and molecule *B* most likely represent

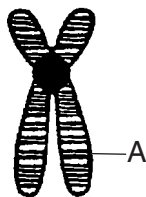
- (1) a nerve signal and a gene
- (2) a receptor and a hormone
- (3) a chromosome and an antigen
- (4) a starch and an amino acid

7 The cytoplasm in a single-celled organism and the circulatory system in a human both

- (1) break down molecules into smaller components
- (2) release energy to be used by the organism
- (3) transport substances throughout the organism
- (4) distribute blood to all of the parts of the organism

- 8 A hydrangea plant has blue flowers when grown in acidic soil, but has pink flowers when grown in basic soil. A clone of the pink-flowered plant is grown in acidic soil and produces blue flowers. This change in flower color is most likely due to
- (1) sexual reproduction in the plants, resulting in variation
  - (2) asexual reproduction in the plants, resulting in variation
  - (3) genes being expressed in different ways due to environmental conditions
  - (4) a gene mutation that occurred after the clone was produced

- 9 The diagram below represents a microscopic structure observed during mitosis.



The region indicated by letter A is known as

- (1) an enzyme
  - (2) a gamete
  - (3) a gene
  - (4) an amino acid
- 10 A significant difference between the effects of the genetic information passed on from asexually reproducing parents to their offspring and sexually reproducing parents to their offspring is the
- (1) degree of modification of the size of chromosomes
  - (2) types of DNA subunits
  - (3) number of chromosomes in the body cells of the offspring
  - (4) amount of variation between the parents and the offspring
- 11 A normal sequence of DNA bases in a single human skin cell is CATGGC. If this sequence replicates in this cell and becomes GATGGC, this alteration will most likely be passed to
- (1) every cell that develops from it
  - (2) all human body cells
  - (3) offspring of the human
  - (4) all skin cells of this person

- 12 Beta cells in the pancreas and human skin cells both contain the insulin gene. The beta cells can make insulin; however, skin cells cannot. Which process is responsible for this gene being expressed in one cell type and *not* in another cell type?

- (1) mitosis
- (2) replication
- (3) differentiation
- (4) meiosis

- 13 Information in segments of human DNA can be expressed by a bacterial cell as a result of

- (1) sexual reproduction
- (2) random mutation
- (3) genetic variability
- (4) genetic engineering

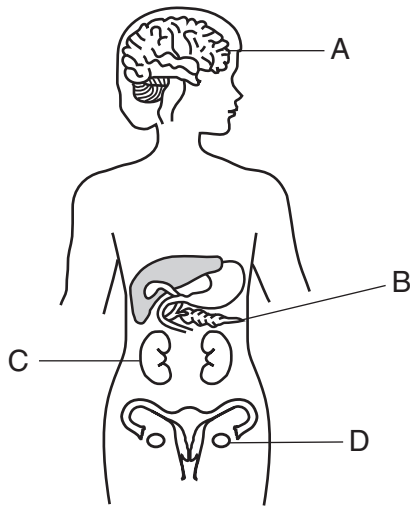
- 14 The photograph below shows a recently discovered all-black penguin chick and several typical black-and-white chicks.



The appearance of this penguin chick with all black feathers might

- (1) increase the types of foods penguins can eat
  - (2) decrease the diversity of the penguin population
  - (3) decrease the number of variations present in the black penguin population
  - (4) result in an increase in black penguins over time if the trait provides a reproductive advantage
- 15 Natural selection and its evolutionary consequences provide a scientific explanation for
- (1) the fossil record of ancient life-forms
  - (2) predictions about the rate of global warming
  - (3) the amount of precipitation in a rain forest
  - (4) the amount of soil used to grow certain crops

16 Some organs in the human body are represented in the diagram below.

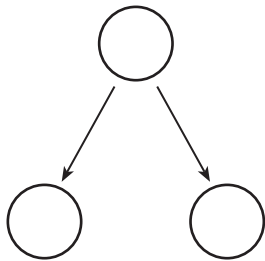


A sudden change in the DNA of cells developing in which organ could be passed to future generations?

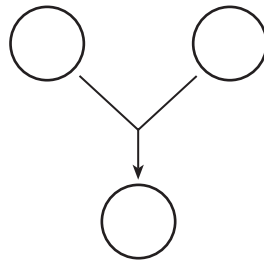
- (1) A
- (2) B
- (3) C
- (4) D

17 Two cellular events that normally occur during two processes are represented below.

**Cellular Event A**



**Cellular Event B**



Which row in the chart below correctly identifies the processes in which these events occur?

Row	Cellular Event A	Cellular Event B
(1)	asexual reproduction	sexual reproduction
(2)	zygote formation	cloning
(3)	sexual reproduction	asexual reproduction
(4)	cloning	egg formation

18 Photosynthesis and respiration are alike in that they both

- (1) require the Sun as a direct source of energy
- (2) result in the production of glucose molecules
- (3) require specific catalysts
- (4) occur within mitochondria

19 The reproductive cycle in females is regulated primarily by

- (1) estrogen and testosterone
- (2) estrogen and progesterone
- (3) progesterone and insulin
- (4) progesterone and testosterone

20 One function of the male reproductive system in mammals is to

- (1) produce insulin necessary for sexual reproduction
- (2) transport eggs necessary for fertilization
- (3) allow for delivery of gametes needed for reproduction
- (4) provide protection for the developing zygote

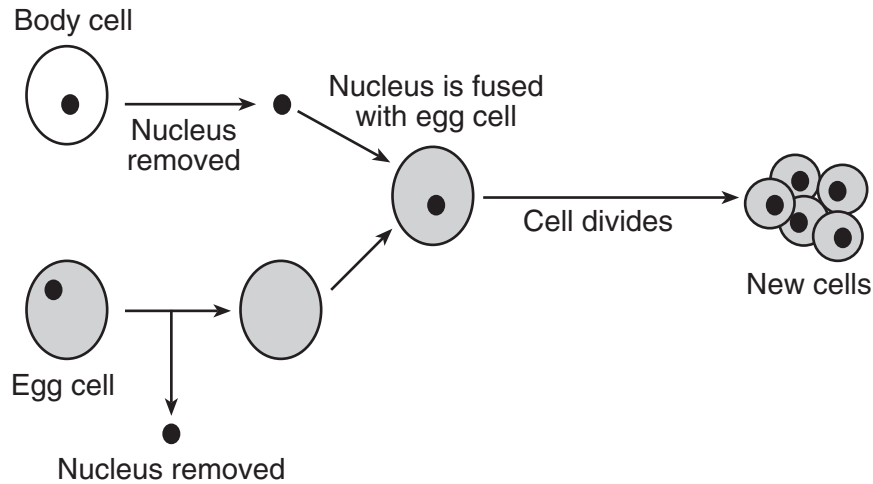
21 A zygote develops into a multicellular organism through

- (1) mitosis and specialization
- (2) mitosis and meiosis
- (3) recombination and communication
- (4) genetic engineering and natural selection

22 *Pneumocystis* is an organism normally found in the human lungs that can cause pneumonia. It seldom causes problems in individuals with healthy immune systems. However, people with AIDS sometimes become seriously ill with pneumonia. This is most likely due to the fact that individuals with AIDS have

- (1) inherited a tendency to contract pneumonia
- (2) difficulty fighting off infections
- (3) an allergy to this organism
- (4) hormones that strengthen the infection

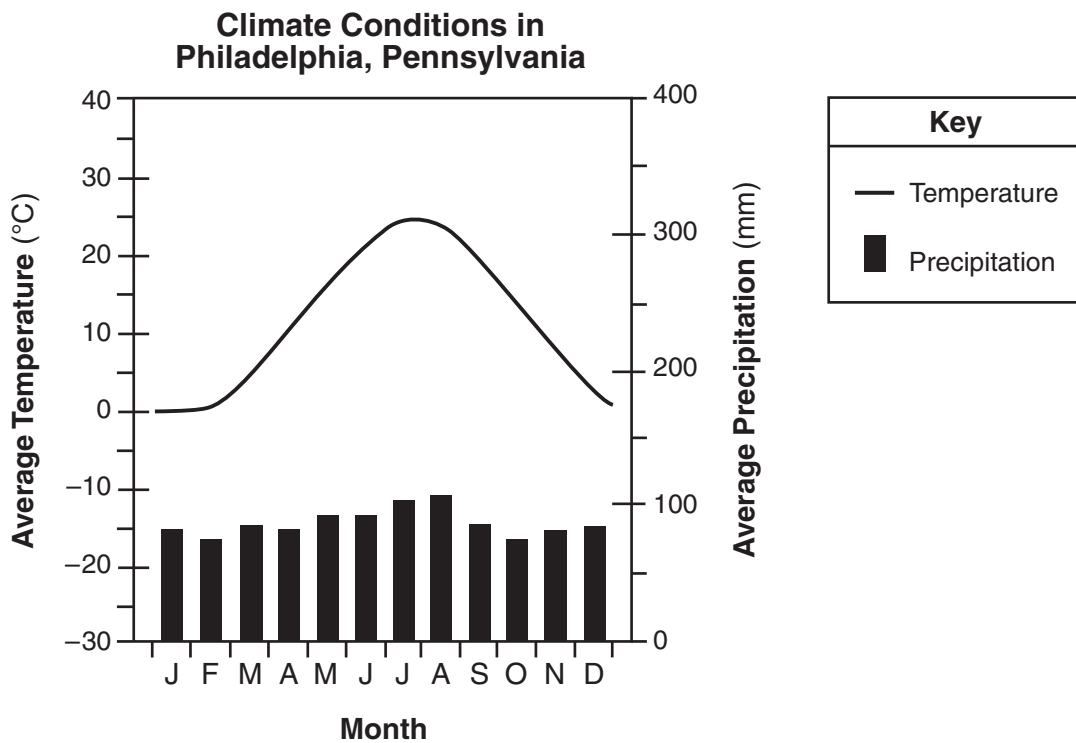
23 A technique used to alter cells is represented in the diagram below.



The genetic material contained in the nucleus of each of the new cells is most likely

- (1) identical to that in the original body cell
- (2) identical to that in the original egg cell
- (3) 50% the same as the original egg cell and 50% the same as the original body cell
- (4) 25% the same as the original egg cell and 75% the same as the original body cell

24 A graph is shown below.



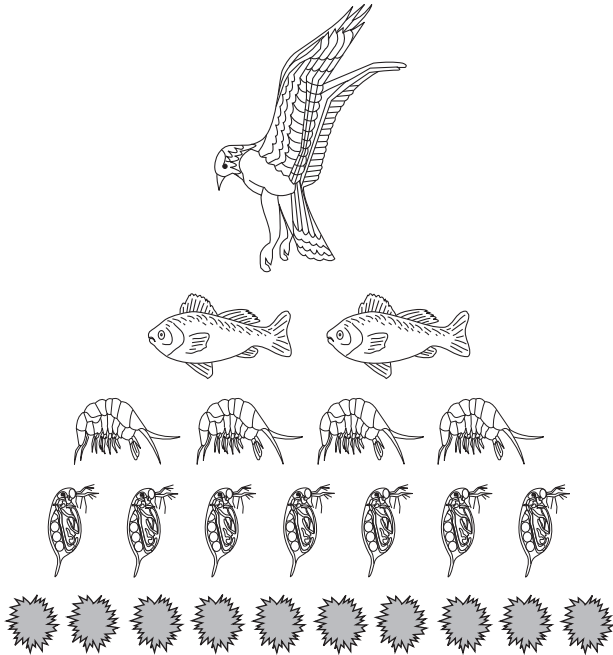
The graph contains information about

- (1) finite resources
- (2) limiting factors
- (3) biotic factors
- (4) mineral availability

25 Nicotine is only one of the many toxic chemicals inhaled while smoking. What effect can such toxic chemicals have on the body?

- (1) They stimulate an increase in height.
- (2) They stimulate uncontrolled cell division.
- (3) They eliminate carbon dioxide from cells.
- (4) They eliminate chromosomes from many cells.

26 The diagram below represents different feeding levels in an energy pyramid.



The most likely explanation for showing fewer organisms at each feeding level going up the pyramid is that

- (1) some energy is lost to the environment as heat
- (2) the larger the organism, the less energy it requires
- (3) some energy is recycled within each level and remains there
- (4) decomposers convert most of the energy into inorganic compounds

27 Which process uses energy to combine inorganic molecules to synthesize organic molecules?

- (1) respiration
- (2) digestion
- (3) photosynthesis
- (4) decomposition

28 The Nature Conservancy is an organization that protects a variety of habitats around the world. A project this organization would probably support is one that

- (1) uses endangered animals for medical research
- (2) protects the biodiversity of areas for future generations
- (3) alters habitats for industry and housing
- (4) prevents animal species from migrating to other habitats

29 Certain animal species that are endangered or threatened have been cloned. Closely related species have been used to carry the embryos of the endangered species. This process of increasing the population size of a species in danger of becoming extinct is an example of a

- (1) natural method to decrease ecosystem stability
- (2) natural method of controlling the population of an endangered species
- (3) technological fix to increase habitat destruction
- (4) technological fix for the problem of endangered species

30 Car manufacturers have begun to explore the use of biofuels, such as biodiesel, ethanol, and cooking oils made from plant material. The desired outcome of using these biofuels would be

- (1) a decrease in the use of fossil fuels
- (2) a decrease in the release of oxygen gas
- (3) an increase in abiotic resources
- (4) an increase in global warming

**Part B-1**

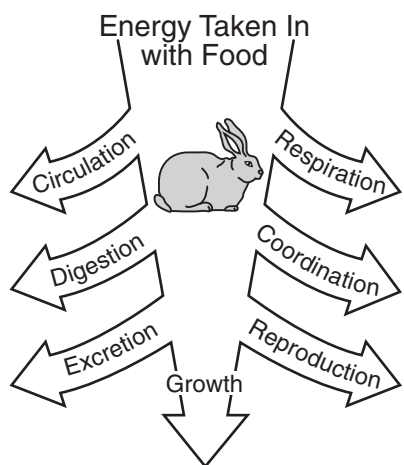
**Answer all questions in this part.** [13]

*Directions (31–43):* For *each* statement or question, record on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

31 In the 18th century, Carolus Linnaeus classified organisms based on their structural similarities. Modern classification determines relationships more accurately because it is based on genetic and other biochemical similarities. This change in classification method best illustrates that

- (1) multiple trials are required to increase the validity of a scientific explanation
- (2) scientific explanations are subject to the ethical view of the scientist proposing them
- (3) peer review is required to validate the results of scientific investigations
- (4) all scientific explanations are tentative and subject to change and improvement

32 Rabbits have evolved strategies that get them through periods of time when there is little food. The diagram below represents essential life functions that rabbits need to perform.



Which life function in the diagram could be eliminated without affecting an individual rabbit's ability to survive when food is scarce?

- (1) digestion
- (2) excretion
- (3) circulation
- (4) reproduction

33 The inability of an organism to produce certain proteins can occur when an organism is lacking an enzyme needed to combine

- (1) oxygen molecules
- (2) simple sugars
- (3) amino acids
- (4) biological catalysts

34 Bumblebees show some ability to control their own body temperature. During cold weather, bumblebees have been observed warming their flight muscles by shivering. The bees are able to maintain a body temperature several degrees above that of the surrounding air. Regulation of their internal body temperature is an example of

- (1) diffusion
- (2) synthesis
- (3) respiration
- (4) homeostasis

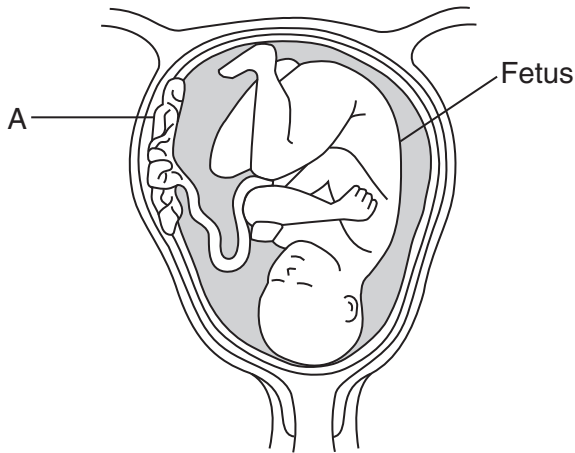
35 A cell begins to produce a new type of protein. This is most likely due to an alteration of the

- (1) structure of the cell membrane
- (2) sequence of bases in a section of a chromosome
- (3) chemical makeup of the cytoplasm
- (4) shape of the antibodies produced by the nucleus

36 Mother rattlesnakes care for and protect their young. Baby rattlesnakes find safety in the coils of their mothers. Female snakes stay together for the first few weeks after giving birth. This gathering of female rattlesnakes provides a safe environment for newborn rattlers. This is an example of which type of adaptation?

- (1) structural
- (2) nutritional
- (3) molecular
- (4) behavioral

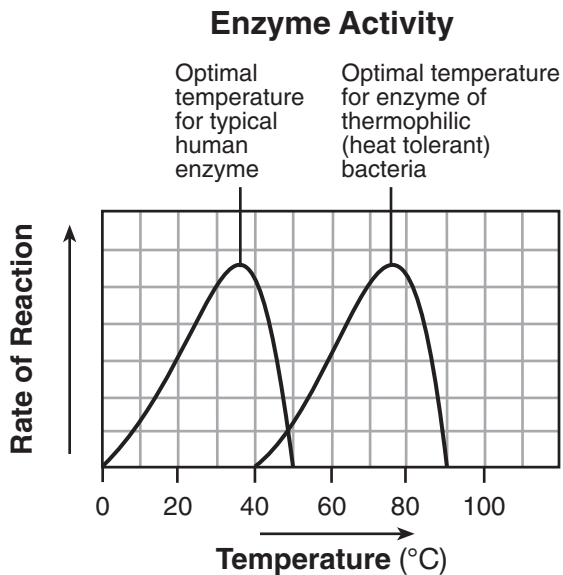
37 The diagram below represents one stage during the human reproductive process.



A function of structure A is to

- (1) remove nutrients from the fetus
- (2) provide the fetus with metabolic wastes
- (3) remove all toxins from the blood of the mother
- (4) provide for the exchange of oxygen and carbon dioxide

38 Which statement is supported by the information in the graph below?



- (1) The enzymes respond in a similar way to changes in temperature.
- (2) The enzymes in bacteria function best at 40°C.
- (3) The enzymes function best at the same temperature.
- (4) The enzymes break down the same substances.

39 Farmland abandoned in 1899 was observed to have significant changes in plant species over a 50-year period. The changes are shown in the chart below.

**Changes in Plant Species on Abandoned Farmland**

Year Observed	Plant Species
1900	grasses
1910	shrubs and briars
1920	birch and cherry trees
1950	beech and maple trees

A forest fire burned all the trees on the land in 1955. Assuming no human interference, climate changes, or natural disasters, the plant species you would expect to see on this land in 2010 would most likely be

- (1) grasses
- (2) shrubs and briars
- (3) birch and cherry trees
- (4) beech and maple trees

40 A list of environmental issues is shown below.

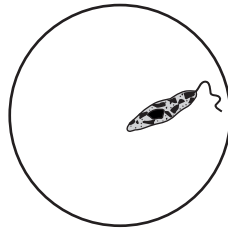
- Rabbits transported from Europe overrun and deplete farmlands in Australia.
- Many areas in the southeastern United States are overgrown with the kudzu plant from Asia.
- In parts of New York State, bluebirds must compete with starlings originally brought here from England.

All of these issues are the result of

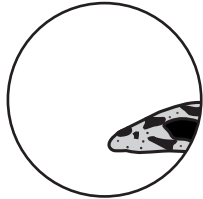
- (1) introduction of nonnative species into stable ecosystems
- (2) genetic engineering without using adequate safety precautions
- (3) preservation of habitats due to human population growth
- (4) use of foreign species to replace native predators



41 The diagram below represents a specimen in the low-power field of view of a compound light microscope.



If the slide is not moved, which view best represents the way the specimen will look when the high-power objective lens is switched into place?



(1)



(2)

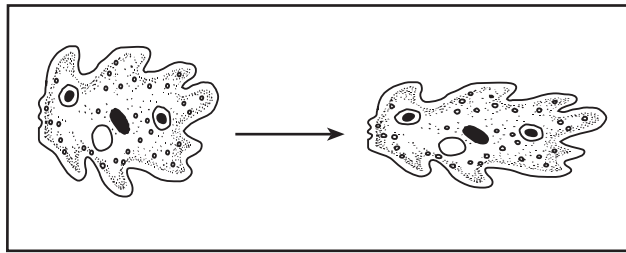


(3)



(4)

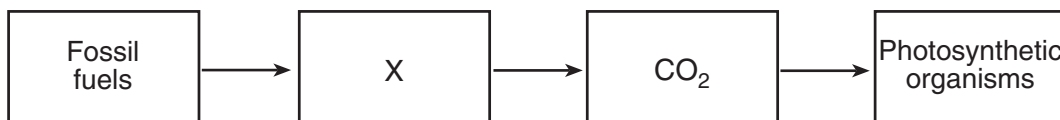
42 Two methods of moving from place to place are represented below. The single-celled ameba moves by a process that involves the flow of cytoplasm.



Which statement is best supported by these diagrams?

- (1) Both simple and complex organisms move directly by the movement of cytoplasm.
- (2) Single-celled organisms, like complex organisms, are able to move; however, they differ in the way they carry out this activity.
- (3) Cytoplasm is a fluid substance in simple cells and a solid substance in cells of complex organisms.
- (4) Cells in complex organisms function in the exact same way as cells in simple organisms.

Base your answer to question 43 on the diagram below and on your knowledge of biology.



43 What information would be appropriate to add to box X in order to complete the diagram?

- (1) cellular respiration by humans
- (2) simple sugar
- (3) oxygen
- (4) burned by automobiles

## Part B-2

Answer all questions in this part. [12]

*Directions (44–55):* For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes each statement or answers each question. For all other questions in this part, follow the directions given and record your answers in the spaces provided in this examination booklet.

Base your answers to questions 44 through 47 on the information and data table below and on your knowledge of biology.

Onondaga Lake is a small lake located near Syracuse, New York. Industrialized municipal wastes have been polluting the lake for decades. Eating fish from the lake has been banned due to mercury concentrations in the fish. The data table below indicates the mercury concentrations in smallmouth bass taken from Onondaga Lake. Smallmouth bass eat smaller fish, which feed on aquatic plants.

At each feeding level in the food chain, more mercury accumulates. The older and larger the fish, the greater the concentration of mercury.

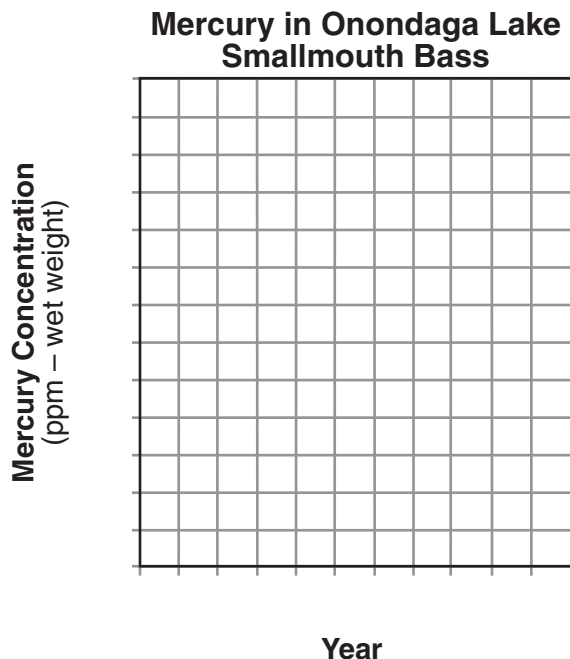
**Mercury in Onondaga Lake  
Smallmouth Bass**

Year	Mercury Concentration (ppm – wet weight)
2000	1.5
2001	2.0
2002	1.75
2003	1.0
2004	2.5
2005	2.25

Directions (44–45): Using the information in the data table, construct a line graph on the grid below, following the directions below.

44 Mark an appropriate scale, without any breaks in the data, on each labeled axis. [1]

45 Plot the data on the grid. Surround each point with a small circle and connect the points. [1]



46 Explain how mercury dumped into the lake and taken up by plants reached the smallmouth bass population. [1]

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**Note: The answer to question 47 should be recorded on your separate answer sheet.**

47 Which statement could be a possible explanation for the drop in mercury concentration in the fish of Onondaga Lake between the years 2002 and 2003?

- (1) Between 2000 and 2005, a large number of fish were sampled.
- (2) The dumping of industrial waste was prohibited in 2004.
- (3) More young fish were tested in 2003, compared to the other years.
- (4) The industrial waste contained more mercury in 2004.

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Base your answers to questions 48 and 49 on the passage below and on your knowledge of biology.

Most animal fossils include hard body parts such as teeth and bones. Until recently, scientists had little hope that soft tissue could be preserved in the bones. A team of scientists has removed soft tissue containing a collagen protein from the leg bone of a 68-million-year-old fossil from a dinosaur, *Tyrannosaurus rex*. The technique of mass spectrometry was used to identify the sequences of certain molecules in several small fragments of the dinosaur collagen protein.

The molecular sequences were compared to those of modern animals. The scientist found that the collagen protein of the *Tyrannosaurus rex* more closely resembled the collagen protein found in modern chickens than that in some other modern animals.

48 State *one* kind of evidence that would support the conclusion that birds evolved from dinosaurs like *Tyrannosaurus rex*. [1]

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**Note: The answer to question 49 should be recorded on your separate answer sheet.**

49 When the scientists compared the molecular sequences in the collagen proteins of the *Tyrannosaurus rex* to those of modern animals, they were most likely seeking information about

- (1) patterns of behavior
- (2) reproductive cycles
- (3) common ancestry
- (4) changing environmental conditions

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Base your answers to questions 50 through 52 on the information below and on your knowledge of biology.

### Found: A Plant-Eating Spider

Spiders are meat-eaters. Until recently, scientists thought that was true for the roughly 40,000 spider species in the world. Now, researchers have discovered a spider that eats mostly plants.

*Bagheera kiplingi*, a jumping spider, lives in Central America and Mexico. It nests in the leaves of acacia shrubs. Scientists have long known that ants live in these plants. The ants eat the plants' little yellow vegetables. But scientists had no idea that the spiders eat the vegetables too.

Christopher Meehan was a college student when he found the plant nibbling spiders. "I thought I was hallucinating," he told TFK (Time for Kids). "But by the end of the day, I had seen about 100 more spiders eating plants."

Source: *Time for Kids World Report*,  
Edition 10/23/09 Vol. 15, #7 p.3

**Note: The answer to question 50 should be recorded on your separate answer sheet.**

50 Which row best characterizes *Bagheera kiplingi* and acacia shrubs?

Row	<i>Bagheera kiplingi</i>	Acacia
(1)	host	parasite
(2)	consumer	producer
(3)	autotroph	heterotroph
(4)	scavenger	herbivore

51 Identify *one* abiotic factor that most likely affects the size of the acacia shrub population. [1]

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52 Is competition likely to occur between the *Bagheera kiplingi* and ants living in acacia shrubs? Support your answer. [1]

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Base your answers to questions 53 through 55 on the passage below and on your knowledge of biology.

Inherited instructions control the color patterns of snakes. Some snakes that are not poisonous have colors that resemble the patterns on poisonous snakes. Predators avoid eating harmless snakes that have color patterns similar to those of the poisonous snakes. The results of a recent study indicate that predators in areas that have only harmless snakes do not avoid attacking snakes that have color patterns similar to poisonous snakes.

53 Identify the structure that contains the inherited instructions that determine the different color patterns in these snakes. [1]

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54 State *one* advantage for a nonpoisonous snake having coloration similar to that of a poisonous snake. [1]

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55 State *one* reason why predators in some areas attack and eat harmless snakes, even though they have color patterns similar to those of poisonous snakes. [1]

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**Part C**

**Answer all questions in this part.** [17]

*Directions (56–72):* Record your answers in the spaces provided in this examination booklet.

56–59 *Daphnia* are freshwater organisms sometimes referred to as “water fleas.” Design an experiment that could be used to test the effects of temperature on the size of a *daphnia* population. In your experimental design, be sure to:

- state a hypothesis to be tested [1]
- describe how the control group will be treated differently from the experimental group [1]
- identify the independent variable in the experiment [1]
- identify the type of data that will be collected [1]

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Base your answers to questions 60 through 62 on the passage below and on your knowledge of biology.

### A Vaccine to Treat Addiction

A vaccine for cocaine addiction has been developed. This vaccine temporarily blocks the effects of cocaine. The vaccine consists of a cocaine molecule attached to the surface of an inactive, harmless cholera protein.

Since cocaine molecules alone are too small to stimulate the immune system to create antibodies, they are attached to the cholera protein. When people are injected with the vaccine, their bodies make antibodies against cholera. They also make antibodies against cocaine. When cocaine later enters the bloodstream, the antibodies bind to cocaine and prevent it from leaving the bloodstream, so it does not reach the brain. If the drug does not reach the brain, the user does not feel its effect. When antibodies were blocking the cocaine, people who took cocaine didn't get an effect from it, so the drug lost its appeal. Later, an enzyme breaks down the cocaine and it is flushed out of the body.

One problem revealed by the trial was that only 38 percent of vaccinated subjects developed high levels of antibodies against the drug. Additionally, the vaccine's protection seems to last for only about two months. Users need to receive booster shots every few months for approximately two years to make a complete recovery from the addiction.

60 Identify the *two* main substances contained in the vaccine. [1]

\_\_\_\_\_ and \_\_\_\_\_

61 Describe *one* effect the cocaine vaccine has on the immune system. [1]

\_\_\_\_\_  
\_\_\_\_\_

62 How does this vaccine help to treat cocaine addiction? [1]

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_



Base your answers to questions 63 and 64 on the information below and on your knowledge of biology.

Mosquito Technologies of New York, Inc., has developed a Mosquito Killing System (MKS) to help control the mosquito population and reduce the transmission of West Nile Virus. The MKS works by taking advantage of the natural hunting strategies of mosquitoes, such as heat sensing and carbon dioxide detection. Beneficial insects do not use the same hunting strategies. The MKS unit produces heat and releases carbon dioxide in cycles, mimicking the breathing and body temperatures of humans, pets, and other warm-blooded animals. This attracts the mosquitoes to the device and, once inside, a vacuum pulls them in, where they pass through an electrocution grid, killing them. The mosquito remains are then returned to the environment through the bottom of the unit.

The unit contains a solar-powered photocell that turns the device on at dusk and turns it off at dawn.

63 State *one* positive effect the use of this MKS device has on the environment. [1]

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64 A town wants to buy a number of MKS devices to solve their mosquito problem. One individual is concerned that this device could have a negative effect on insects that are beneficial to the environment. Based on the information given, is this a valid concern? Support your answer. [1]

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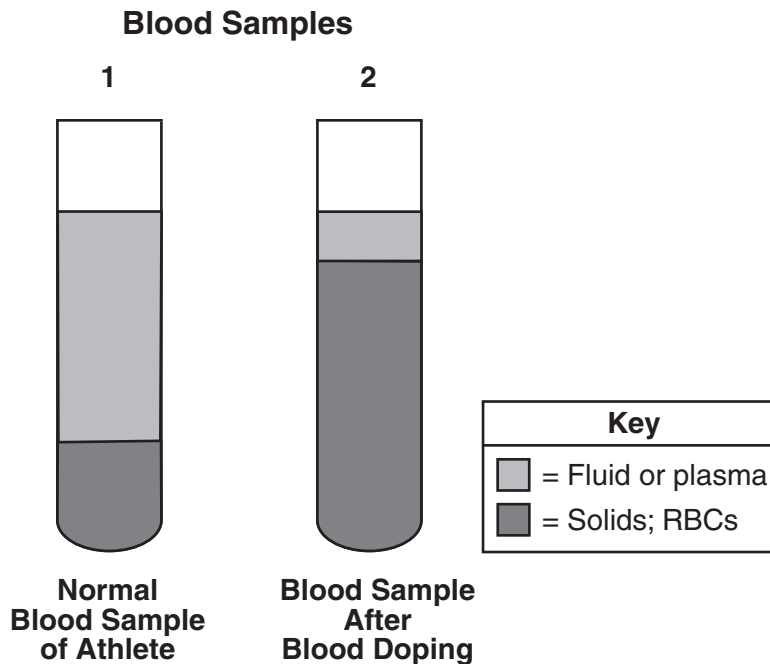
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Base your answers to questions 65 through 67 on the information and diagram below and on your knowledge of biology.

### Blood Doping

Blood is a fluid tissue, which means that blood cells are suspended in a fluid called plasma. Blood tests are concerned with not only the number of blood cells present, but with the amount of plasma that surrounds the cells.

The diagram below represents tubes containing blood samples from an athlete before and after blood doping. Blood doping is an illegal practice reportedly used by some athletes a few weeks before an athletic event, and involves removing whole blood from an athlete, separating the oxygen-carrying red blood cells (RBCs), and then freezing them. These RBCs are thawed and returned to the athlete's body just before the athlete competes. Serious health risks are associated with this practice.



65 Explain why athletes who practice blood doping would be expected to perform better at an athletic event. [1]

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66 State *one* reason why the extra RBCs represented in sample 2 could be dangerous to the health of an athlete. [1]

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67 More middle- and long-distance runners have tested positive for blood doping than short-distance runners, such as sprinters. State *one* reason why athletes participating in certain events might be more likely to practice blood doping than others. [1]

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Base your answers to questions 68 and 69 on the information below and on your knowledge of biology.

A woman wanted to remove the dandelion plants from her lawn. She went to the store and bought an herbicide spray that was supposed to kill the dandelions. She sprayed it on her lawn according to the directions. Within two weeks, almost all of the dandelions had died; however, a few dandelions remained.

68 Explain how some dandelions were able to survive the spraying of the herbicide. [1]

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69 Explain why this herbicide might *not* be effective for controlling future generations of dandelions in this lawn. [1]

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Base your answers to questions 70 through 72 on the information below and on your knowledge of biology.

### Types of Predators

When large predators, such as lions or wolves, are removed from a food web, smaller “mesopredators” step in to take their places, and the results may be severe. Mesopredators are usually smaller and more numerous than the larger “apex” predators that they replace. Some are also omnivores, eating plant and animal food sources, rather than eating the meat-only diet of the largest predators. Examples of mesopredators include coyotes, raccoons, and skunks.

In 1874, General George Custer noted that there was an abundance of wolves, but few coyotes, in South Dakota. Today, there is an abundance of coyotes, but no wolves. The wolves were removed to protect domestic sheep, but now the coyotes are often responsible for attacking sheep and other animals. The cost of controlling mesopredators by human intervention can be very high, as mesopredators are very numerous and quickly “bounce back” after control efforts. Meanwhile, the number of apex predators that are endangered continues to increase.

70 Describe how the wolf population is controlled naturally in the environment without human intervention. [1]

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71 State how the mesopredator population was most likely controlled before the wolves were removed from the food web. [1]

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72 If apex predators are so valuable to the ecological balance, state *one* possible reason why wolves were removed from the food web. [1]

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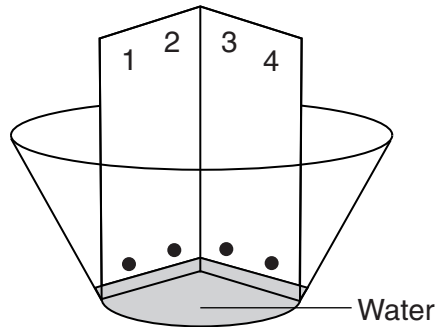
## Part D

Answer all questions in this part. [13]

*Directions (73–85):* For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes the statement or answers the question. For all other questions in this part, follow the directions given and record your answers in the spaces provided in this examination booklet.

**Note: The answer to question 73 should be recorded on your separate answer sheet.**

73 A laboratory setup that can be used to provide information about relationships between four plant species is represented below.



This setup is part of the technique known as

- (1) electrophoresis
- (2) biological staining
- (3) dissection
- (4) chromatography

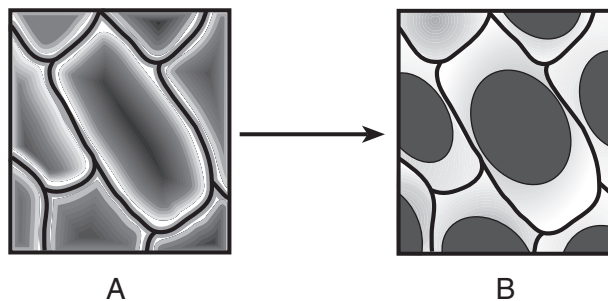
**Note: The answer to question 74 should be recorded on your separate answer sheet.**

74 When people exercise, their body cells build up more waste quickly. Which two body systems work together to remove these wastes from their cells?

- (1) immune and endocrine
- (2) digestive and skeletal
- (3) respiratory and circulatory
- (4) circulatory and digestive

**Note: The answer to question 75 should be recorded on your separate answer sheet.**

75 Red onion cells undergo the change represented in the diagram below.



This change is most likely caused by the cell being transferred from

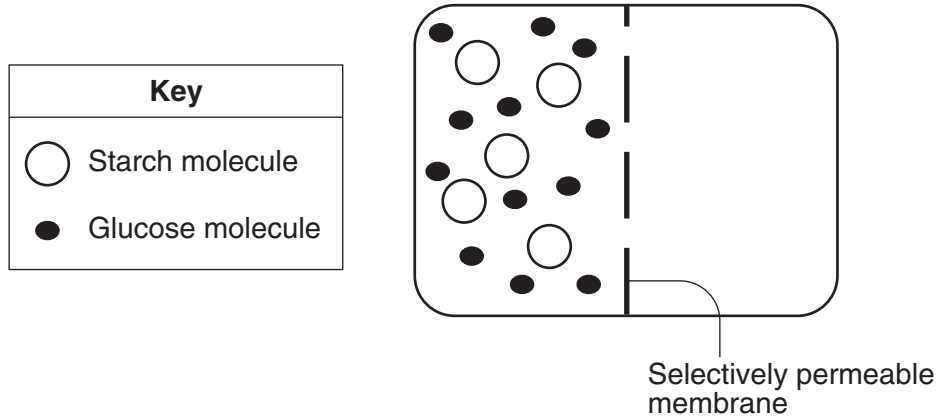
- (1) distilled water to starch indicator
- (2) distilled water to salt water
- (3) salt water to tap water
- (4) salt water to distilled water

**Note: The answer to question 76 should be recorded on your separate answer sheet.**

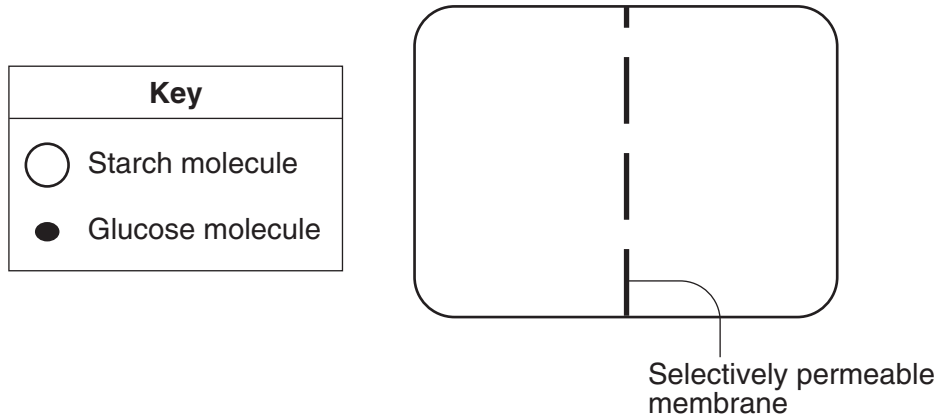
76 Which chemicals are used to cut DNA into fragments for a gel electrophoresis procedure?

- (1) enzymes
- (2) molecular bases
- (3) hormones
- (4) ATP molecules

77 The diagram below represents a laboratory setup used to demonstrate the movement of molecules across a selectively permeable membrane.



In the diagram below, draw the 5 starch and the 12 glucose molecules to show where they would most likely be located after 15 minutes. [1]



Base your answers to question 78–79 on the Universal Genetic Code Chart below and on your knowledge of biology.

**Universal Genetic Code Chart**  
**Messenger RNA Codons and the Amino Acids for Which They Code**

		SECOND BASE				
		U	C	A	G	
FIRST BASE	U	UUU } PHE UUC } UUA } LEU UUG }	UCU } UCC } SER UCA } UCG }	UAU } TYR UAC } UAA } STOP UAG }	UGU } CYS UGC } UGA } STOP UGG } TRP	U C A G
	C	CUU } CUC } LEU CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A	AUU } AUC } ILE AUA } AUG } MET or START	ACU } ACC } THR ACA } ACG }	AAU } ASN AAC } AAA } LYS AAG }	AGU } SER AGC } AGA } ARG AGG }	U C A G
	G	GUU } GUC } VAL GUA } GUG }	GCU } GCC } ALA GCA } GCG }	GAU } ASP GAC } GAA } GLU GAG }	GGU } GGC } GLY GGA } GGG }	U C A G

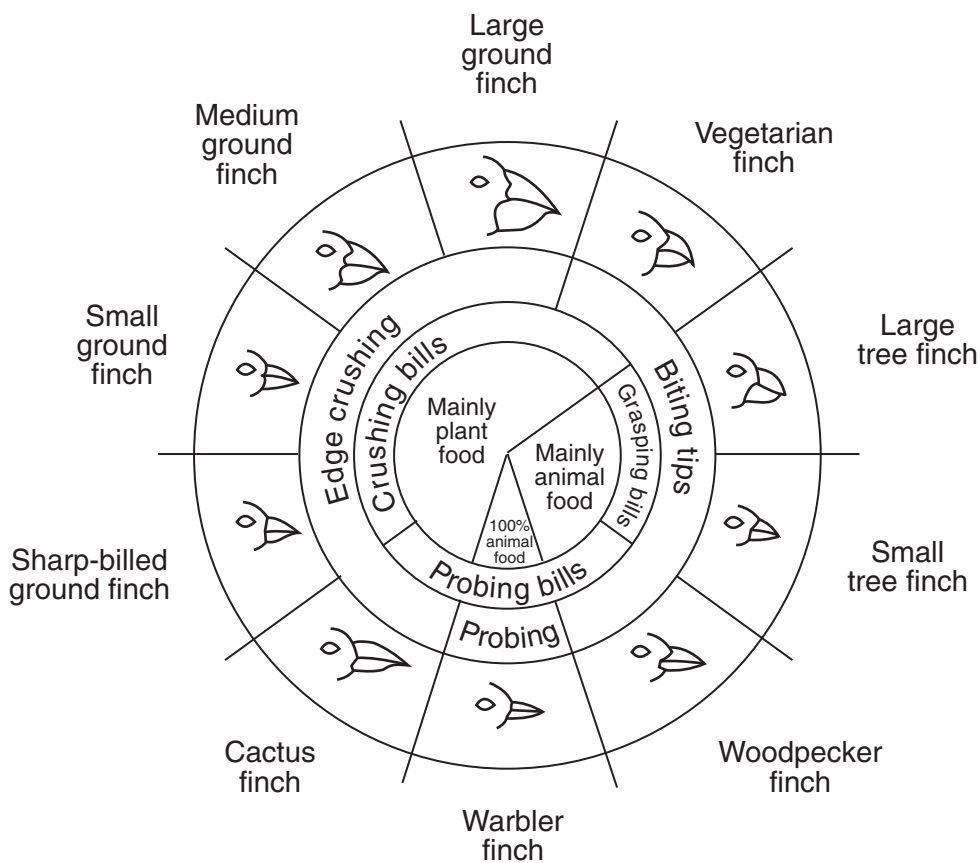
- 78–79 • In the table below, record the mRNA codons coded for by the DNA base sequences. [1]  
 • Then, using the Universal Genetic Code Chart, record the amino acid sequence that is coded for by the mRNA codons you placed in the table. [1]

DNA Base Sequence	AAG	CCA	TGA	ACA
mRNA codons	_____	_____	_____	_____
Amino acid sequence	_____	_____	_____	_____

80 A student hypothesized that drinking tea would cause an increase in pulse rate. He measured his pulse 20 minutes after drinking a glass of tea. It was 86 beats per minute. State *one* error in the experiment. [1]

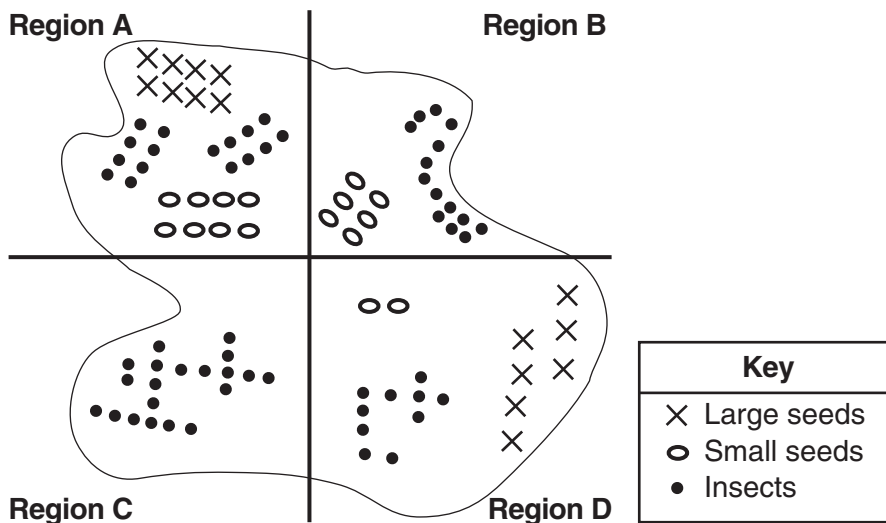
Base your answers to questions 81 through 84 on the diagrams below and on your knowledge of biology. The diagrams represent the variations in the beaks of finches in the Galapagos Islands and the relative abundance of food sources on a certain island.

### Variations in Beaks of Galapagos Islands Finches



From: *Galapagos: A Natural History Guide*

### Relative Abundance of Food Sources on a Certain Island





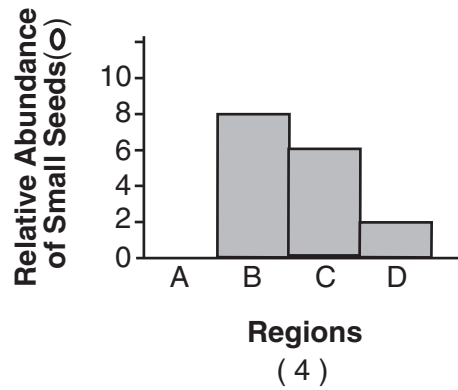
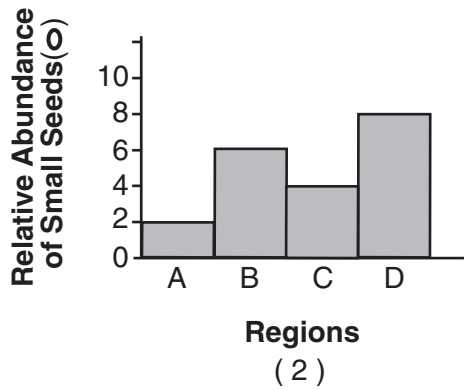
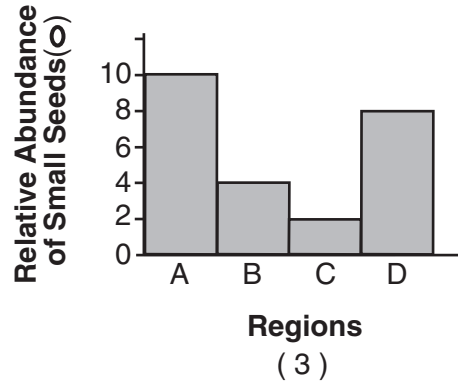
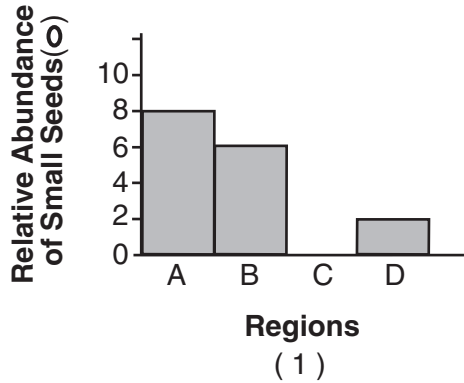
**Note: The answer to question 81 should be recorded on your separate answer sheet.**

81 The diagram of the island suggests that in region *B* finches can feed on

- (1) large seeds and insects
- (2) small seeds, only
- (3) a large variety of different-sized seeds
- (4) insects and a limited number of small seeds

**Note: The answer to question 82 should be recorded on your separate answer sheet.**

82 Which histogram displays the relative abundance of small seeds in regions *A*, *B*, *C*, and *D*?



83 Explain why researchers would most likely observe the large ground finch in regions *A* and *D* on the island and *not* in regions *B* and *C*. [1]

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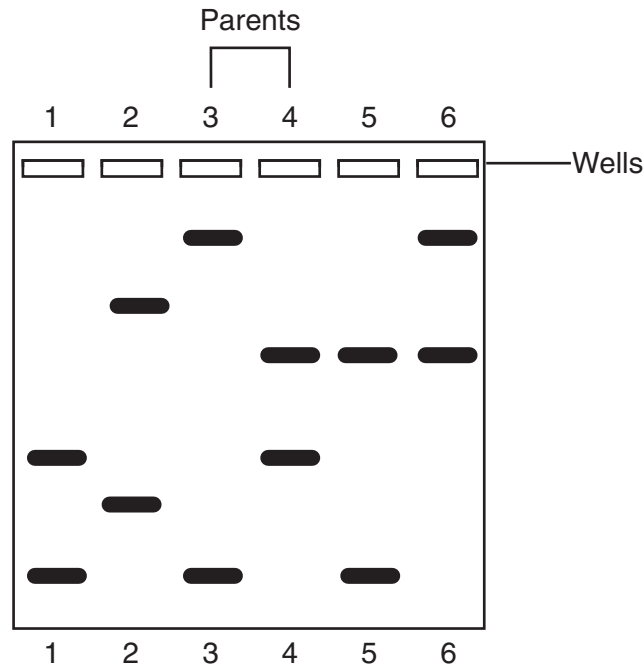
84 A bird count was done on the island and the small tree finch was found in all regions. State *one* possible reason why the small tree finch is able to inhabit the entire island. [1]

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85 Several days after a litter of three purebred puppies was born, a breeder noticed one extra puppy in the litter. The diagram below shows the results of electrophoresis of DNA fragments from all of the dogs. The puppies are labeled 1, 2, 5, and 6. The parent dogs are labeled 3 and 4.



Identify which puppy might have been placed into this litter by mistake. Support your answer. [1]

Puppy: \_\_\_\_\_

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