

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

# LIVING ENVIRONMENT

**Wednesday, August 14, 2013 — 12:30 to 3:30 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 The organisms in a pond and the physical factors influencing them best describe

(1) a population (3) a biosphere  
(2) an ecosystem (4) a food chain

- 2 Which row in the chart below best describes decomposers?

Row	Method of Nutrition	Recycles
(1)	autotrophic	nutrients
(2)	heterotrophic	nutrients
(3)	autotrophic	energy
(4)	heterotrophic	energy

- 3 Some processes that occur in a cell are listed below.

A. utilize energy  
B. detect changes in the environment  
C. rearrange and synthesize chemical compounds

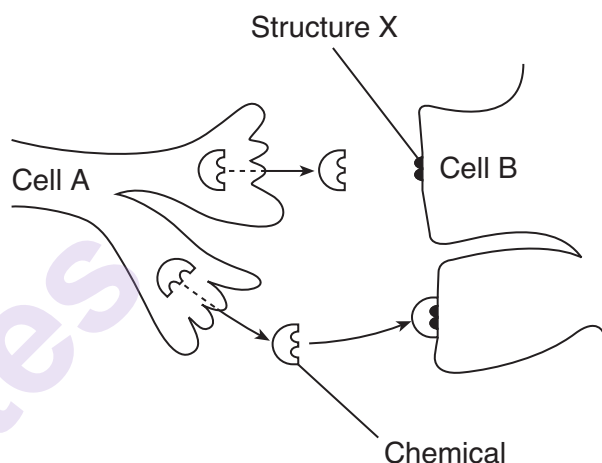
Which processes will all living organisms use to maintain homeostasis?

(1) A and B, only (3) C and A, only  
(2) B and C, only (4) A, B, and C

- 4 Which cell structures are correctly paired with their functions?

(1) The mitochondria produce enzymes, and ribosomes transport them.  
(2) The ribosomes make proteins, and the nucleus stores genetic information.  
(3) The cell membrane makes enzymes, and cytoplasm transports them.  
(4) The vacuole stores genetic information, and chloroplasts make proteins.

- 5 The diagram below represents the region between two nerve cells. Cell A releases a chemical that travels to and binds with structure X on cell B.



Structure X most likely represents

(1) a receptor molecule  
(2) an inorganic substance  
(3) a ribosome  
(4) an antibody

- 6 Over the past few thousand years, humans have helped to bring about changes in many plant and animal species in order to make them more useful. Examples include strong workhorses, hunting dogs, large-eared corn, and beautiful flower varieties. These changes were primarily brought about by humans, using the process of

(1) mitosis (3) cloning  
(2) selective breeding (4) natural selection

- 7 Certain antibacterial soaps kill 99% of the bacteria present on hands. Constant use of these soaps could be harmful over time because

(1) more pathogens may be resistant to the soap  
(2) microbes prevent viral diseases  
(3) large populations of pathogens are beneficial to the hands  
(4) the soap stimulates skin cell division

8 Which factor would cause two specialized tissues that contain identical chromosomes to function differently?

- (1) Specific sections of DNA molecules in the chromosomes are activated.
- (2) All of the sections of DNA molecules in the chromosomes are activated.
- (3) Specific sections of the amino acid molecules in the cytoplasm are activated.
- (4) All of the amino acid molecules in the cytoplasm are activated.

9 Some variation must be present in a population in order for natural selection to take place. These variations arise from mutations in the DNA and

- (1) sorting of chromosomes during sexual reproduction
- (2) combining of chromosomes during organ development
- (3) changing of chromosomes during cloning
- (4) removal of chromosomes during selective breeding

10 The diagram below represents a segment of a gene on two chromosomes.

Normal gene	A	T	A	C	C	T
Mutated gene	A	T	G	C	C	T

The change in the gene sequence is an example of

- (1) an insertion
- (2) a deletion
- (3) a substitution
- (4) a replication

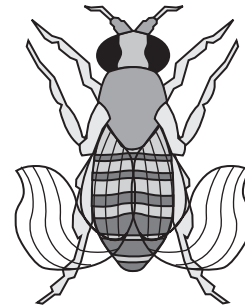
11 In a certain species of insect, some individuals have flattened white disks on their bodies that protrude and interlock, resembling an orchid flower. This adaptation provides the insect with a better opportunity to capture its prey. If environmental conditions remain unchanged, it is most likely that, in future generations, the proportion of the population with this adaptation will

- (1) increase, only
- (2) decrease, only
- (3) increase, then decrease
- (4) decrease, then increase

12 Which structure is correctly paired with its function?

- (1) ovary — provides milk for newborns
- (2) testis — development of sperm
- (3) placenta — storage of released eggs
- (4) uterus — produces estrogen

13 The fruit fly represented in the diagram below has unusual, curled wings that formed after exposure to radiation.



In order for the fly to pass this trait on to its offspring, a change had to occur in

- (1) the blood cells of the fly
- (2) the gametes of the fly
- (3) all the body cells of the fly
- (4) the muscles of the fly

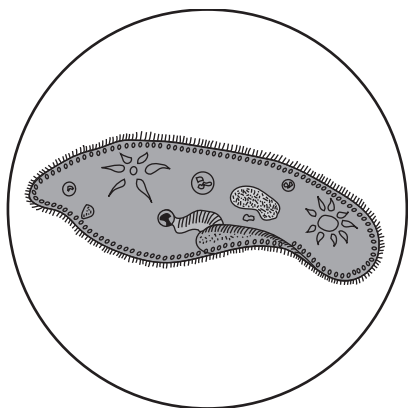
14 In a population of birds, the percentage of individuals having a certain gene changes from 20% to 60% over the span of several hundred years. This situation will most likely affect the rate of

- (1) biological evolution
- (2) asexual reproduction
- (3) gene mutation
- (4) ecological succession

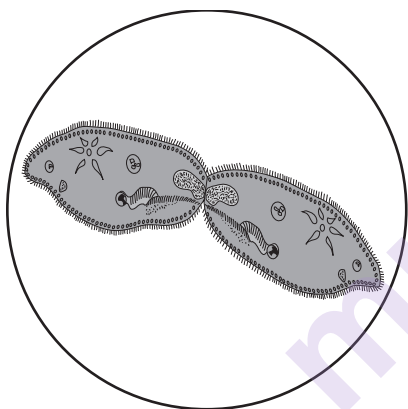
15 The finite resources of Earth are often affected by increasing human consumption. These finite resources are

- (1) not renewable over a short period of time
- (2) the products of rapid human population growth
- (3) the result of deforestation
- (4) needed to degrade ecosystems

- 16 A student made the drawing shown below of a single-celled organism as he observed it with a compound light microscope under the high-power objective.



Several minutes later, he drew the diagram shown below of the same organism, using the same magnification.



These drawings show that the organism is carrying out the process of

- (1) asexual reproduction
  - (2) sexual reproduction
  - (3) embryo formation
  - (4) genetic alteration
- 17 Which statement best describes why pathogens are harmful?
- (1) All of the cells of an organism infected by pathogens become pathogens.
  - (2) Pathogens cannot be controlled once they enter the cells of an organism.
  - (3) Pathogens produce antibodies that will kill the host organism.
  - (4) Pathogens can interfere with normal life functions.

- 18 In 1996, scientists cloned the first mammal, a sheep. This technique involved the removal of the nucleus from an egg cell. The nucleus from a cell of another adult sheep was then inserted into this egg cell. Once this cell began to develop into an embryo, it was implanted into a third female sheep that later gave birth to a healthy lamb, Dolly. Which statement concerning Dolly is correct?

- (1) Her offspring would be genetically identical.
- (2) Dolly and her DNA donor are genetically identical.
- (3) Two different gametes were manipulated to produce Dolly.
- (4) Dolly was produced by the recombination of genetic material.

- 19 Which activity would most likely increase the mutation rate in a culture of bacteria being grown in a laboratory experiment?

- (1) adding more distilled water to the culture
- (2) adding excess nutrients to the culture
- (3) exposing the culture to a higher concentration of  $\text{CO}_2$
- (4) exposing the culture to ultraviolet radiation

- 20 Which two processes are responsible for keeping the percentage of atmospheric oxygen at relatively constant levels?

- (1) circulation and coordination
- (2) respiration and coordination
- (3) respiration and photosynthesis
- (4) photosynthesis and circulation

- 21 Chemicals that help chemical reactions occur at faster rates in living organisms are known as

- (1) biotic resources
- (2) simple sugars
- (3) oxygen molecules
- (4) organic catalysts

- 22 The action of insulin on sugar levels in the blood helps to

- (1) interfere with homeostasis
- (2) maintain dynamic equilibrium
- (3) coordinate enzyme production
- (4) regulate digestion of protein

- 23 An individual recovers from the common cold, which is caused by rhinovirus A. The person then becomes infected with the avian influenza virus, which causes the bird flu. Which statement best describes what will most likely happen to this person?
- (1) He will have the symptoms of the bird flu because he is not immune to the avian influenza virus.
  - (2) He will have the symptoms of the common cold because he is not immune to the avian influenza virus.
  - (3) He will not have the symptoms of the bird flu because he is immune to rhinovirus A.
  - (4) He will not have the symptoms of the common cold because the avian influenza virus causes it.
- 24 The wetland plant purple loosestrife was imported to North America from Europe. Since its introduction, the loosestrife has spread, which has resulted in a dramatic decline in the biological diversity of native wetland plants. A likely reason for the spread of the purple loosestrife is that it can
- (1) successfully compete with native herbivores for food
  - (2) serve as an excellent food source for native herbivores
  - (3) successfully compete with native plants for space
  - (4) prevent the migration of native plants
- 25 Deer ticks are responsible for spreading Lyme disease. This organism, which feeds on the blood of warm-blooded organisms like mice, deer, and humans, is best described as a
- (1) predator
  - (2) scavenger
  - (3) parasite
  - (4) host
- 26 Years ago, an article was written titled “Medicine Chest in the Jungle.” This article most likely described the
- (1) potential for ecosystems to be a source for new drugs
  - (2) dangers of poisonous jungle plants and animals
  - (3) deforestation of jungles for the development of large pharmacies
  - (4) use of antibiotics to treat certain disorders in trees
- 27 After a building was torn down and the area was cleared, grasses began to grow in the area. Several years later, small bushes replaced the grasses. This pattern of plant growth is known as ecological
- (1) stability
  - (2) cultivation
  - (3) succession
  - (4) coordination
- 28 A human activity that could significantly *decrease* the amount of carbon dioxide in the air is
- (1) increasing the use of fossil fuel
  - (2) controlling insect pests that eat stored grain
  - (3) burning garbage and trash to generate electricity
  - (4) preserving and expanding forest habitats that shelter wildlife
- 29 Ethanol-fueled vehicles have increased in popularity as people try to be more environmentally responsible. Ethanol can be made from corn. Some farmers are clearing forests and planting large expanses of corn to meet the rising demand. Which statement describes a likely result of this increased corn production?
- (1) There will be a reduction in the biodiversity of areas that are converted to grow corn.
  - (2) The corn will produce more carbon dioxide than it uses, contributing to global warming.
  - (3) Insect biodiversity in the area will increase.
  - (4) Growing more corn will increase the nutrient content of the soil.
- 30 Windmills that generate electricity are being built in coastal areas. The main benefit of these windmills is that they
- (1) produce finite resources
  - (2) reduce dependency on fuels that cause air pollution
  - (3) absorb the noise of passing boats
  - (4) maintain the salt concentration in the ocean

## 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 The dichotomous key below provides a way to classify some animals into groups according to their physical characteristics.

Dichotomous Key	
I wings.....	go to II
no wings.....	group A
II feathers.....	group B
no feathers.....	go to III
III two legs.....	group C
six legs.....	group D

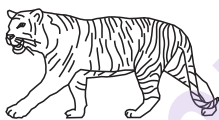
The key can be used to classify each of the four animals represented below.



Wasp



Ant



Tiger

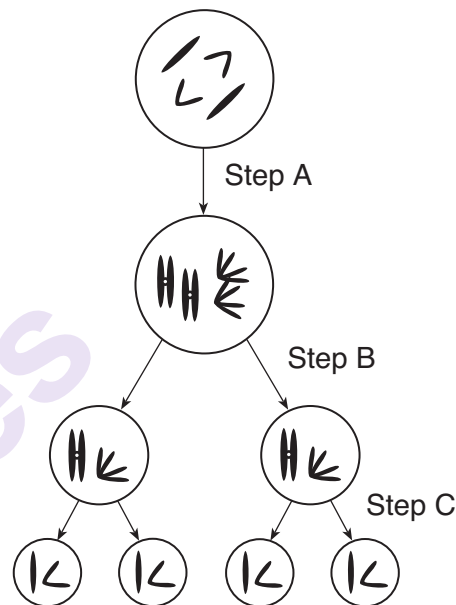


Bird

Which row in the chart shows the correct classification group for each animal?

Row	Wasp	Ant	Tiger	Bird
(1)	group D	group D	group A	group B
(2)	group B	group A	group D	group C
(3)	group B	group D	group A	group C
(4)	group D	group A	group A	group B

- 32 Part of a process necessary for reproduction in complex organisms is represented below.

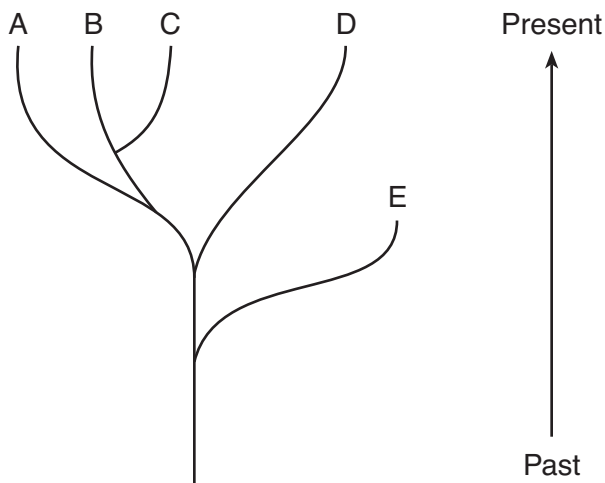


Step C results in the production of

- (1) four zygotes that will develop into embryos
- (2) embryonic cells that could unite and develop into an organism
- (3) four cells that will recombine to form two offspring
- (4) gametes that could be involved in the formation of a zygote

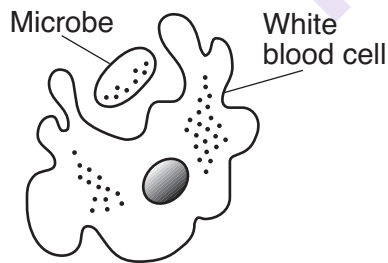


- 33 The diagram below represents an evolutionary tree.



Which statement best describes species *E*?

- (1) Species *D* is an ancestor of species *E*.
  - (2) Through natural selection, species *E* produced increased survival mechanisms.
  - (3) Species *E* had greater success due to patterns of behavior.
  - (4) Species *E* had insufficient adaptive characteristics for survival in a changing environment.
- 34 The diagram below represents one type of white blood cell. This type of white blood cell ingests microbes.



A function of another type of white blood cell is to

- (1) prevent the loss of blood from a wound
- (2) produce specialized molecules that mark invaders
- (3) increase the number of red blood cells in the blood
- (4) cause gene mutations that will increase immune responses

- 35 The table below indicates a reproductive pattern in some sea turtles when eggs develop in areas with differing temperatures.

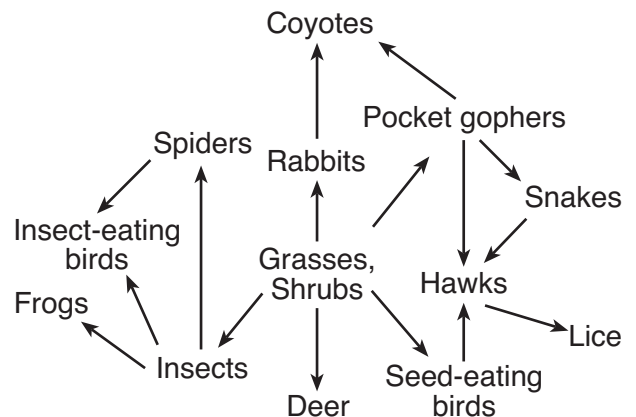
**Sex Determination in Sea Turtles**

Temperature (°C)	Offspring Produced
below 23	usually none
23–27	mostly males
28–30	50/50 males: females
31–33	mostly females
above 33	usually none

The sex of turtle offspring is most probably

- (1) determined only by genes inherited from the parent turtles
- (2) controlled entirely by the location where the young are raised
- (3) a result of genetic information being influenced by environmental conditions
- (4) an identical pattern to the reproductive pattern found in humans

- 36 The diagram below represents a food web.



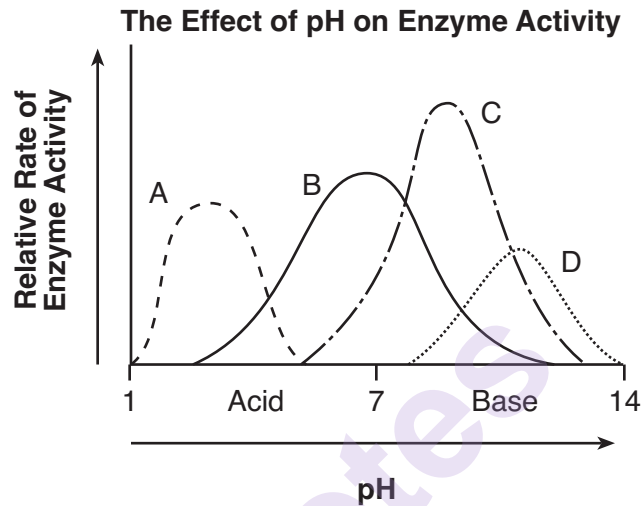
Which statement regarding organisms in this food web is correct?

- (1) There would be more snakes than pocket gophers.
- (2) There would be more coyotes than rabbits.
- (3) There would be more insects than insect-eating birds.
- (4) There would be more hawks than seed-eating birds.

Base your answers to questions 37 through 39 on the information and graph below and on your knowledge of biology.

The pH of the internal environment of lysosomes (organelles that contain digestive enzymes) is approximately 4.5, while the pH of the surrounding cytoplasm is approximately 7. The average pH of the human stomach during digestion is approximately 2.5, while the average pH of the small intestine during digestion is about 8.

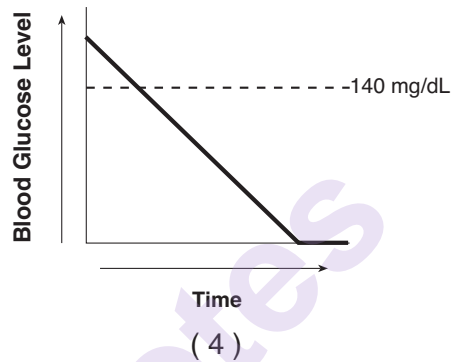
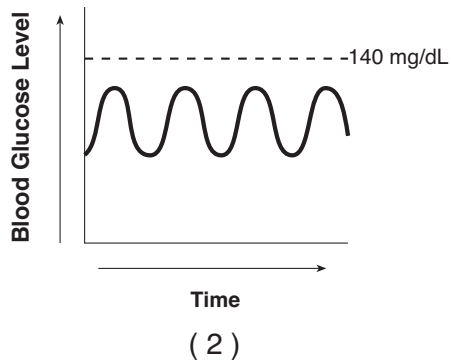
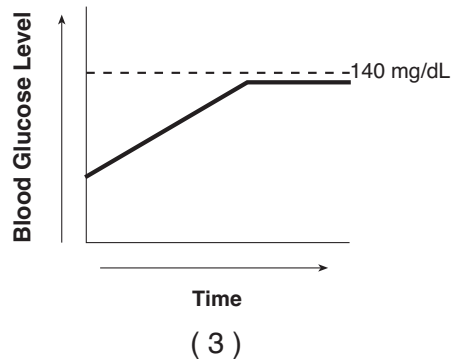
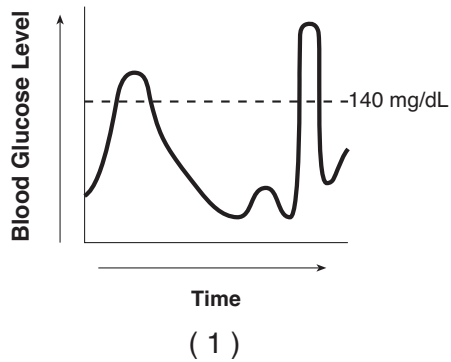
The graph below shows how pH affects the enzyme activity of four different enzymes, A, B, C, and D.



- 37 What will most likely happen to the action of an enzyme from the small intestine if it is placed in an environment similar to the environment in which enzyme C functions best?
- (1) It would no longer be able to function because the environment is too acidic.
  - (2) It would adapt to the new environment and start carrying out the same function as enzyme C.
  - (3) It would continue to function because it is able to modify the pH of the environment.
  - (4) It would be able to function because the pH of the environment is similar to that of the intestine.
- 38 Lysosomes break open during the process of digestion, releasing enzymes into the cytoplasm. Which statement may explain why the entire cell may not be digested?
- (1) The acidic environment of the cytoplasm destroys the enzymes.
  - (2) Antibodies in the cytoplasm break down foreign enzymes.
  - (3) The pH of the cytoplasm causes the enzymes to function less effectively.
  - (4) Enzymes can function only in the location where they are synthesized.
- 39 Which enzyme functions best in a pH environment most similar to that of human stomach enzymes?
- (1) A
  - (2) B
  - (3) C
  - (4) D
-



- 40 The blood glucose range for a healthy adult is 65–104 mg/dL. Which graph best illustrates normal blood glucose levels in a healthy adult over the course of a day?



Base your answers to questions 41 through 43 on the information below and on your knowledge of biology.

...Unless actions are taken to slow the decline of domesticated honeybees and augment [increase] their populations with wild bees, many fruits and vegetables may disappear from the food supply, said Claire Kremen, a conservation biologist at Princeton University in New Jersey...

The honeybee decline, which is affecting domesticated and wild bee populations around the world, is mostly the result of diseases spread as a result of mites and other parasites as well as the spraying of crops with pesticides, scientists say...

Source: "Bee Declines May Spell End of Some Fruits, Vegetables,"  
National Geographic News, October 5, 2005

- 41 The decrease in the honeybee population is partly due to
- (1) the use of pesticides
  - (2) a decrease in prey
  - (3) the use of fertilizers
  - (4) a decrease in fruits and vegetables
- 42 A decrease in honeybee populations will
- (1) eliminate the need to spray crops
  - (2) increase the number of bee parasites
  - (3) reduce the occurrence of natural disasters
  - (4) disrupt the stability of an ecosystem
- 43 Some honeybees have been able to survive the changes in their environment and reproduce. This is most likely due to
- (1) the aggressive behavior of wild bees
  - (2) an abundance of food sources for the bees
  - (3) genetic diversity in the bees
  - (4) lack of mutations in the bees

## 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 48 on the information and data table below and on your knowledge of biology.

### Yellowstone Park Wolf Update

For the first time in nearly 70 years, the howl of the wolf is being echoed throughout Yellowstone National Park. *Canis lupus*, the gray wolf, one of the largest and most complex of the canine species, has been successfully reintroduced into the Yellowstone ecosystem.

In mid-January 1995, 14 wolves from many separate packs were captured in Canada and then transported into Yellowstone Park and placed into three one acre pens...

Source: <http://www.yellowstone-bearman.com/w-update.html>

After the wolves were given time to establish a new pack structure, the packs were released into the wild. The number of wolf pups was counted each year for four years. The data are shown in the table below.

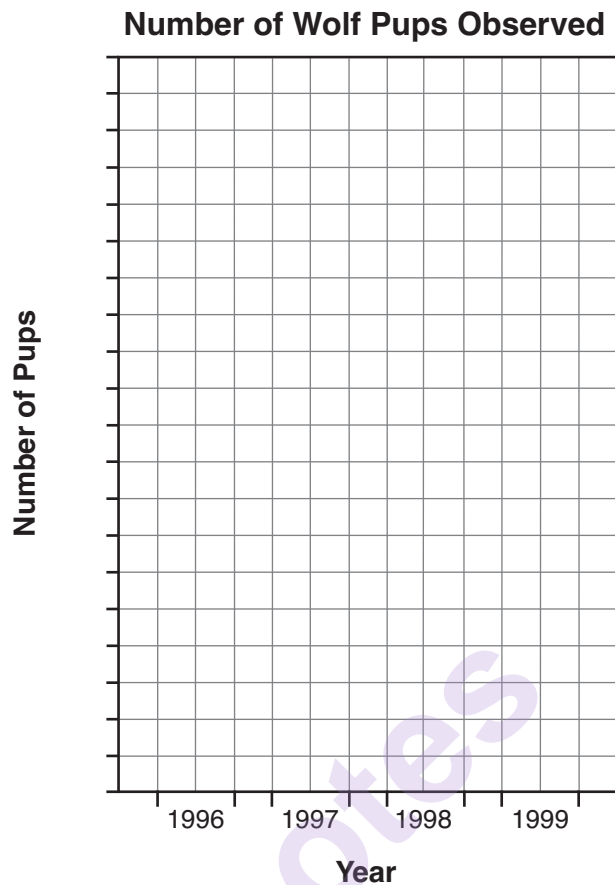
**Number of Wolf Pups Observed**

Year	Number of Pups
1996	11
1997	64
1998	42
1999	61

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

44 Mark an appropriate scale, without any breaks, on the axis labeled “Number of Pups.” [1]

45 Construct vertical bars to represent the data. Shade in *each* bar. [1]



46 State *one* positive result of reintroducing wolves into Yellowstone Park. [1]

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

47 The number of wolves that can be supported in this environment for a long period of time is known as

- |                         |                           |
|-------------------------|---------------------------|
| (1) ecosystem stability | (3) ecological succession |
| (2) carrying capacity   | (4) biological evolution  |

48 State *one* possible reason why the wolf population showed a decline from 1997 to 1998. [1]

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

49 Some levels of organization in a multicellular organism are shown in the sequence below.

$A \rightarrow \text{cells} \rightarrow \text{tissues} \rightarrow B \rightarrow \text{organ systems} \rightarrow \text{organism}$

Which terms represented by letters *A* and *B* would complete the sequence?

- (1) *A*–gametes; *B*–zygote  
 (2) *A*–zygote; *B*–gametes  
 (3) *A*–organs; *B*–organelles  
 (4) *A*–organelles; *B*–organs

Base your answers to questions 50 through 53 on the information and chart below and on your knowledge of biology.

Excess body weight is considered to be a risk factor for diseases such as diabetes and high blood pressure. The Body Mass Index (BMI) chart below can be used as a guide to determine if a person's body weight puts that person at risk for such diseases.

**Body Mass Index (BMI)**

	<b>Healthy</b>		<b>Overweight</b>					<b>Obese</b>			
<b>BMI</b>	<b>19</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>	<b>29</b>	<b>30</b>	<b>35</b>	<b>40</b>	<b>45</b>
<b>Height</b>	<b>Weight in Pounds</b>										
<b>5'0"</b>	97	123	128	133	138	143	148	153	179	204	230
<b>5'1"</b>	100	127	132	137	143	148	153	158	185	211	238
<b>5'2"</b>	104	131	136	142	147	153	158	164	191	218	246
<b>5'3"</b>	107	135	141	146	152	158	163	169	197	225	254
<b>5'4"</b>	110	140	145	151	157	163	169	174	204	232	262
<b>5'5"</b>	114	144	150	156	162	168	174	180	210	240	270
<b>5'6"</b>	118	148	155	161	167	173	179	186	216	247	278
<b>5'7"</b>	121	153	159	166	172	178	185	191	223	255	287
<b>5'8"</b>	125	158	164	171	177	184	190	197	230	262	295
<b>5'9"</b>	128	162	169	176	182	189	196	203	236	270	304
<b>5'10"</b>	132	167	174	181	188	195	202	209	243	278	313
<b>5'11"</b>	136	172	179	186	193	200	208	215	250	286	322
<b>6'0"</b>	140	177	184	191	199	206	213	221	258	294	331
<b>6'1"</b>	144	182	189	197	204	212	219	227	265	302	340
<b>6'2"</b>	148	186	194	202	210	218	225	233	272	311	350
<b>6'3"</b>	152	192	200	208	216	224	232	240	279	319	359

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

50 The BMI for a person who is 5 feet 9 inches tall and weighs 170 pounds is between

(1) 24 and 25

(3) 27 and 28

(2) 25 and 26

(4) 29 and 30

51 Is a person with a BMI of 27 at risk for diseases such as diabetes or high blood pressure? Support your answer. [1]

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52 State whether an individual who is 5 feet 3 inches tall and weighs 146 pounds needs to gain or lose weight in order to be classified as healthy. [1]

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53 Calculate the minimum number of pounds that an individual who is 6 feet 3 inches tall and weighs 232 pounds would have to gain or lose to be classified as a healthy individual with a BMI of 24. [1]

\_\_\_\_\_ pounds

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Base your answers to questions 54 and 55 on the information below and on your knowledge of biology.

The Arctic National Wildlife Refuge in Alaska is over 19 million acres of land. This unique habitat supports many species of land and marine animals, including 36 species of fish and 180 species of birds. Some people want to drill for oil in parts of the refuge. Scientists estimate that the total amount of recoverable oil in the refuge is between 5 and 16 billion barrels.

54 State *one* benefit of drilling for oil in the refuge in Alaska. [1]

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55 Describe *one* environmental problem that could be caused by drilling for oil in the refuge in Alaska. [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.

Base your answer to question 56–58 on the information below and on your knowledge of biology.

### Fish Farming

Fish farming has risen in popularity to the point that, in 2009, it was estimated that 30% of all fish consumed by humans came from fish farms. Fish farms tend to specialize in one or two species of fish, which are produced in great numbers. Fish farms are conveniently located along shorelines, where the fish are contained in pens. Deep-sea vessels are not necessary to harvest the fish, as they are when fish are caught in the wild. The farms provide a relatively inexpensive way to provide protein for a growing world population.

As the technique gains in popularity, however, scientists and coastal residents have become concerned that the concentrated mass of fish in fish farms is producing large quantities of wastes. These wastes may be carried by ocean currents to public beaches and recreational boating areas, making them unusable. Others are concerned that uneaten fish food will decay, produce strong odors, and pollute marine environments miles away. If the wastes are not flushed out of the pens, they accumulate on the ocean floor and create a toxic “dead zone” beneath the fish.

56–58 Describe some aspects of fish farming that are examples of humans interacting with the environment. In your answer, be sure to:

- state *one* specific benefit humans gain from fish farming [1]
- state how biodiversity may be reduced by fish farming and support your answer [1]
- describe the impact, other than a reduction in biodiversity, fish farming may have on the natural ecosystems of coastal water if no changes are made [1]

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Base your answers to questions 59 through 62 on the data table and information below and on your knowledge of biology. The data table describes various pH levels.

**pH Levels**

pH	pH Description
1	very acidic
5	slightly acidic
7	neutral
9	slightly basic
13	very basic

A scientist is concerned about the effects of acid rain on newly fertilized fish eggs in lakes in the Adirondack Mountains of New York State. The scientist would like to investigate the hatching rates of these fish eggs in water at different acidic pH levels. The scientist designed an experiment that could show the effect of an acid pH on the hatching of these fish eggs.

59 State how the control group would be treated differently from the experimental groups. [1]

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60 State *two* factors that must be kept the same in both the experimental groups and the control group. [1]

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61 Describe the type of data to be collected. [1]

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62 State *one* example of experimental results that would show that the increasing acidity of lake water has a *negative* effect on the hatching rate of fish eggs. [1]

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

### The Protein Shredder

In every cell, thousands of important processes are occurring around the clock. One of the ways a cell manages to coordinate all of these processes is by sending protein messages. After the protein messages are delivered and read, they need to be destroyed to prepare for the arrival of the next message.

The task of destroying these proteins falls on cell structures known as proteasomes. Think of a proteasome as a tubelike protein shredder. Protein molecules that have served their purpose are transported to the proteasome, unfolded, fed through the tube, and cut into smaller molecules that can then be used to synthesize new protein molecules. Proteasomes can shred any type of protein.

Individuals with a neurological disorder known as hereditary ataxia have been found to have an excess of protein in the cells of their brains and spinal cords. The abnormal level somehow leads to the death of cells in portions of the cerebellum. These areas of cell loss can be seen on a brain scan.

There are several forms of hereditary ataxia but all of them result in poor coordination. The symptoms progress over a period of years. In the beginning, the individuals experience only minor coordination problems. As time passes, the symptoms become worse. The affected individuals will have poor balance when walking. They will be clumsy and have difficulty talking and swallowing.

- 63 Based on the symptoms shown by individuals with hereditary ataxia, state *two* functions regulated by the cerebellum and spinal cord. [1]

Functions: \_\_\_\_\_ and \_\_\_\_\_

- 64 Explain why researchers could think that proteasomes might *not* be working correctly in nerve cells of individuals with hereditary ataxia. [1]


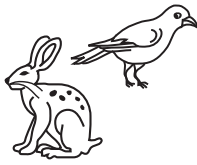

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Base your answer to question 65–68 on the diagram below and on your knowledge of biology. The diagram represents three groups of organisms that are part of an ecosystem.

Groups of Organisms

Plants	Animals	Fungi
		
A	B	C

65–68 Explain the role of these groups of organisms in the cycling of materials and the transfer of energy in an ecosystem. In your answer, be sure to:

- explain why an ecosystem requires a constant input of energy [1]
- explain how organisms in group *B* obtain energy [1]
- explain the role of organisms in group *C* in the ecosystem [1]
- identify the process used by *all three* groups of organisms to make energy available to their cells to carry out life functions [1]

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69–72 Discuss the process used by scientists to insert a gene from one organism into the DNA of another. In your answer, be sure to:

- identify the scientific technique used to insert a gene from one organism into another [1]
- describe the function of a gene [1]
- identify the type of molecule used to cut the gene from the DNA of an organism [1]
- state *one* benefit of this technique to humans [1]

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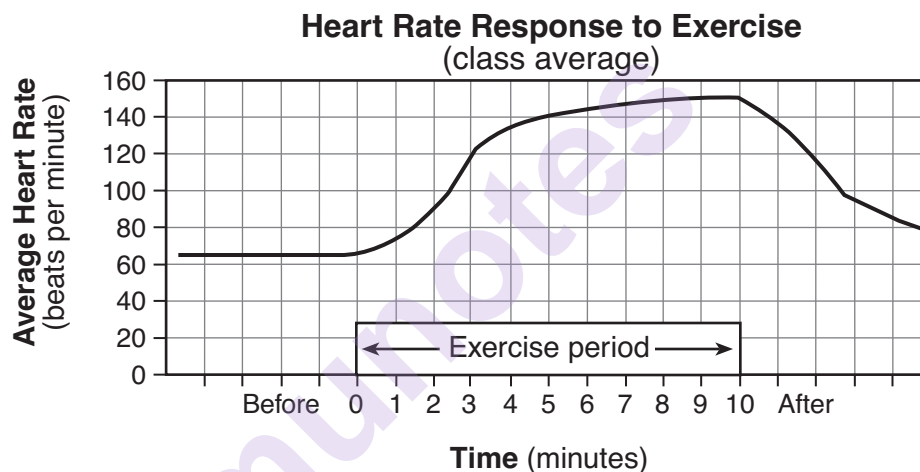
## Part D

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.

Base your answers to questions 73 through 75 on the information and graph below and on your knowledge of biology.

Students were asked to design a lab that investigated the relationship between exercise and heart rate. Heart rate was determined by recording the pulse rate in beats per minute. The students hypothesized that increased exercise results in an increased heart rate. The class results for the experiment are shown in the graph below.



**Note:** The answers to questions 73 through 75 should be recorded on your separate answer sheet.

73 Which statement is best supported by the graph?

- (1) Before exercising, the average pulse rate was 65; four minutes after exercising, the average pulse rate was 65.
- (2) After four minutes of exercising, the average pulse rate was 120; two minutes after exercising, the average pulse rate was 120.
- (3) While exercising, the highest average pulse rate was 150; before exercising, the average pulse rate was 65.
- (4) Two minutes before exercising, the average pulse rate was 80; after two minutes of exercise, the average pulse rate was 140.

74 Students in a different science class carried out the same experiment. The data they obtained did *not* support the hypothesis that increased exercise results in increased heart rate. The most scientifically sound way to deal with this situation is to

- (1) write a new hypothesis
- (2) read about pulse rate in a biology textbook
- (3) have the students in both classes vote to decide which hypothesis is correct
- (4) ask students in a third class to do the experiment and see if their results support the hypothesis

- 75 The change in heart rate that occurs between 1 and 5 minutes of exercise is an adaptation that
- (1) reduces the rate at which oxygen is carried to the muscle cells
  - (2) increases the rate at which carbon dioxide is carried to the muscle cells
  - (3) results in the production of more ATP in muscle cells
  - (4) slows the destruction of enzymes involved in respiration of muscle cells
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**Note: The answer to question 76 should be recorded on your separate answer sheet.**

- 76 A student hypothesized that watching sports on television would cause viewers' pulse rates to increase. She designed an experiment to determine the effect of watching sports on pulse rate. A group of 200 volunteers took their pulse rates and then watched their favorite sports on television. After the games, they immediately took their pulse rates again. The data collected showed that the pulse rates of some people increased, but the pulse rates of an equal number of people did not change. Although the hypothesis was not supported by the data, the hypothesis is still valuable because it
- (1) may lead to further investigation
  - (2) can be changed to fit the data
  - (3) is the opinion of the experimenter
  - (4) is based on beliefs of the volunteers

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Base your answers to questions 77 and 78 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 } LEU CUC } CUA } CUG }	CCU } CCC } PRO CCA } CCG }	CAU } HIS CAC } CAA } GLN CAG }	CGU } CGC } ARG CGA } CGG }	U C A G
	A AUU } ILE AUC } 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

77 The table below shows the DNA, mRNA, and amino acid sequences from two similar plant species. Using the information given, fill in the missing mRNA base sequences for species A on the table below. [1]

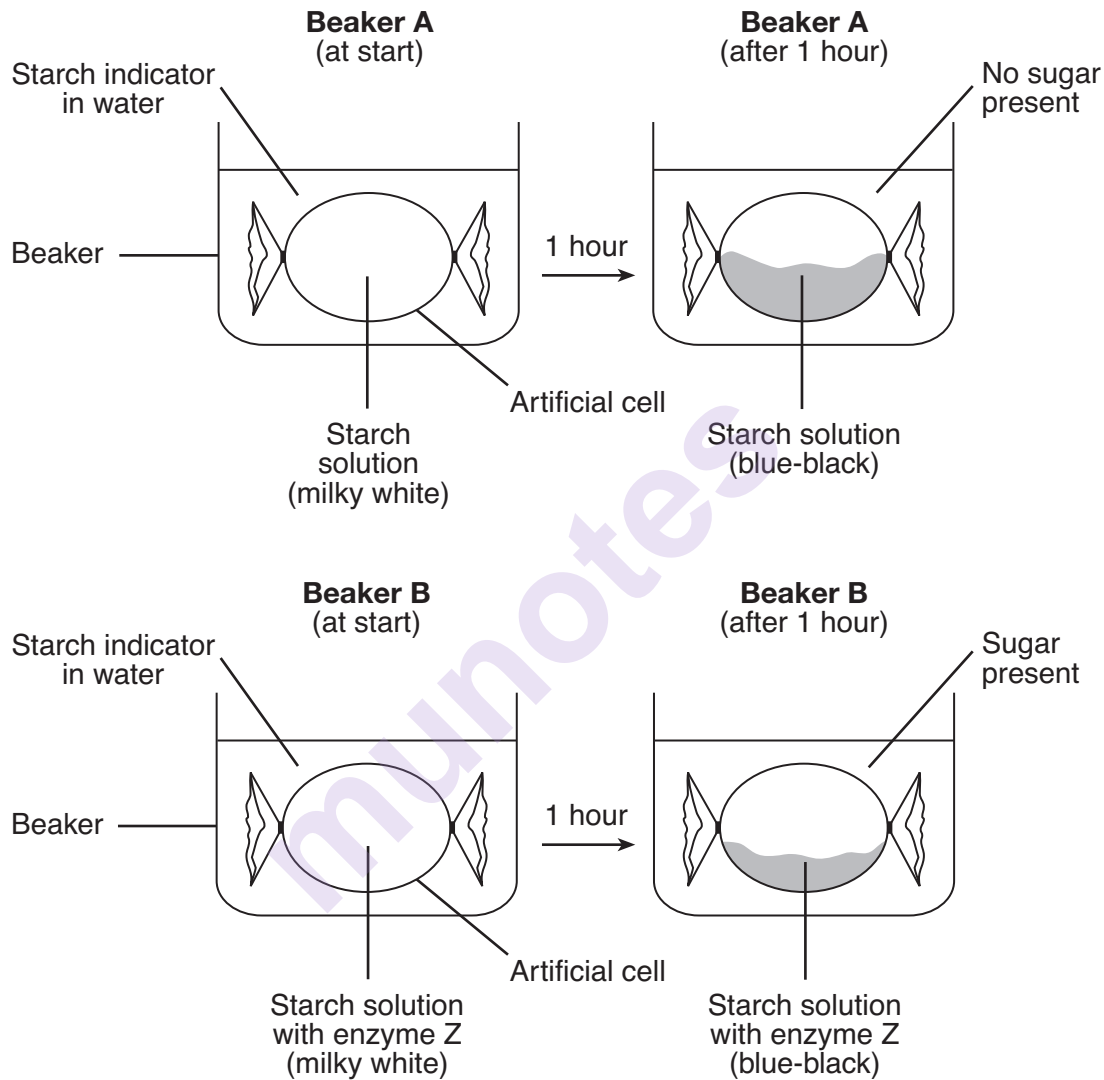
78 Using the Universal Genetic Code Chart, fill in the missing amino acids for species B on the table below. [1]

Species A	DNA base sequence	CCG	TGC	ATA	CAG	GTA
	mRNA base sequence	_____	_____	UAU	_____	_____
	amino acid sequence	GLY	THR	TYR	VAL	HIS
Species B	DNA base sequence	CCG	TGC	ATA	CAG	GTT
	mRNA base sequence	GGC	ACG	UAU	GUC	CAA
	amino acid sequence	GLY	_____	_____	VAL	_____



Base your answers to questions 79 and 80 on the information and diagram below and on your knowledge of biology.

Two models of a cell were made with dialysis tubing and placed in two beakers of fluid, A and B, each containing starch indicator solution, as represented in the diagram below. Enzyme Z was added to the artificial cell in beaker B. The solution outside each cell was tested for the presence of sugar. Initially, no sugar was present in the solution outside each cell. The results after one hour are represented below.



79 State *one* reason for the color change in beaker A after one hour. [1]

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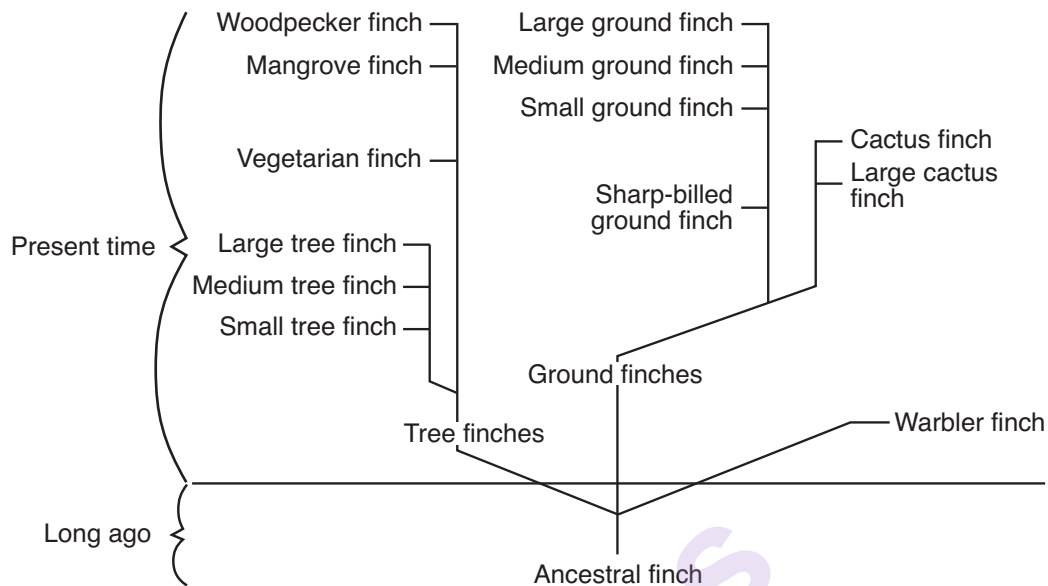
80 How would the results have been different in beaker B if an enzyme that digests protein was used instead of enzyme Z? [1]

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Base your answers to questions 81 and 82 on the chart below and on your knowledge of biology.

**Evolutionary Chart of Galapagos Finches**



adapted from: *Galapagos: A Natural History Guide*

**Note: The answers to questions 81 and 82 should be recorded on your separate answer sheet.**

81 Which finches would be most like the ancestral finch?

- (1) large ground finches
- (2) cactus finches
- (3) warbler finches
- (4) large tree finches

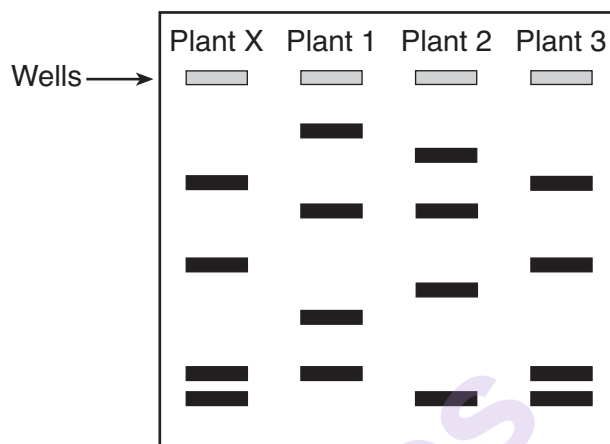
82 Present-day cactus finches are a type of

- (1) tree finch
- (2) ground finch
- (3) warbler finch
- (4) ancestral finch

Base your answers to questions 83 through 85 on the information below and on your knowledge of biology.

As part of a laboratory technique, DNA samples taken from four plants were separated.  
The results are represented in the diagram below.

- 83 Circle the band in the diagram below in the results for plant X that would contain the smallest DNA fragments. Support your answer. [1]



- 84 Which plant is most closely related to plant X? Support your answer using information from the diagram. [1]

Plant number: \_\_\_\_\_

- 85 Identify the technique used to obtain the results represented in the diagram. [1]

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