

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

# LIVING ENVIRONMENT

**Tuesday, June 17, 2014 — 1:15 to 4:15 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.**

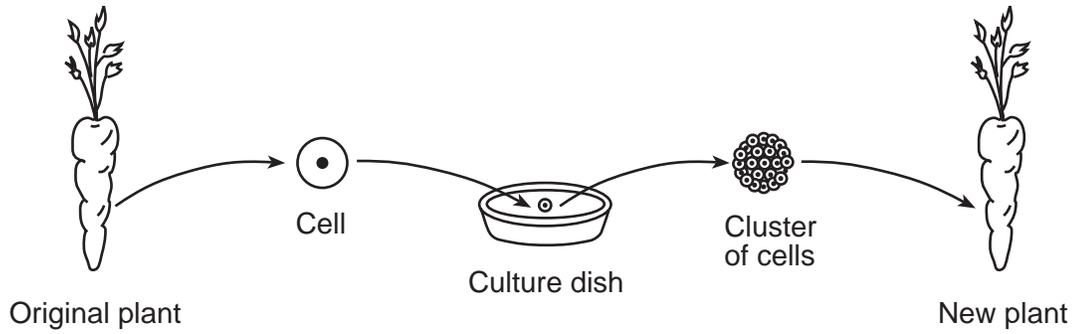
## Part A

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 How do cells in the ovary detect a hormone from the brain?
  - (1) The brain sends a nerve impulse to the ovary.
  - (2) White blood cells bring the hormone to the ovary.
  - (3) Receptor molecules on the cells of the ovary bind with the hormone.
  - (4) Vacuoles within the ovary bind with the hormone.
- 2 Single-celled organisms are able to maintain internal stability because they
  - (1) have multiple organ systems
  - (2) work with other cells
  - (3) contain structures that perform life functions
  - (4) carry out photosynthesis to produce food
- 3 A similarity between humans and many other multicellular animals is that they
  - (1) occupy the same niche in most food webs
  - (2) are composed of organ systems
  - (3) have the same DNA sequences
  - (4) carry out autotrophic nutrition
- 4 In order to enter cells and be useful to the body, starch must be
  - (1) absorbed through the skin
  - (2) broken down into fats and water
  - (3) digested into simple sugars
  - (4) converted to carbon dioxide and ATP
- 5 The increase of certain types of gases in the atmosphere has contributed to the problem of global warming. All these gases are
  - (1) biotic factors
  - (2) abiotic factors
  - (3) organic factors
  - (4) endangered factors
- 6 Several goldfish were kept in a small aquarium for several years. The fish grew to be approximately 6 centimeters long in the first year, and after that, growth in length stopped. These fish were later transferred to a large pond. In the pond, the goldfish grew much larger, reaching lengths of around 25 centimeters. Which statement provides the best explanation for the increased growth of the fish in the pond?
  - (1) Chemicals present in the pond increased the amount of DNA in the fish, causing the growth increase.
  - (2) The expression of genetic information in the fish was influenced by their surroundings.
  - (3) The fish expressed and passed on only those characteristics that enabled them to survive in the new environment.
  - (4) The size of the fish depended only on their food supply and not on their DNA.
- 7 Autotrophs might survive when heterotrophs cannot, because autotrophs are able to
  - (1) reproduce asexually
  - (2) become dormant
  - (3) exist without respiration
  - (4) make their own food
- 8 The inability of sperm cells to move normally could prevent the production of offspring by interfering with
  - (1) meiosis
  - (2) mitosis
  - (3) fertilization
  - (4) differentiation
- 9 Which type of pathogenic microbe causes AIDS?
  - (1) a bacterium
  - (2) a virus
  - (3) a multicellular fungus
  - (4) a single-celled algae

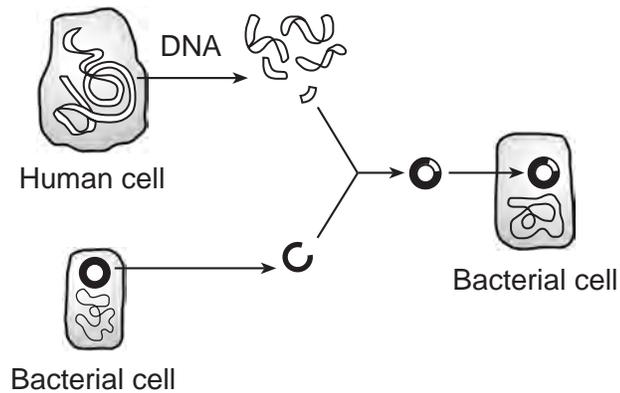
10 The diagram below represents a technique used to produce carrots.



Which reproductive process determines the traits present in the cluster of cells?

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

11 The diagram below represents a scientific technique in use today.



Scientists have used this technique to

- (1) produce hormones for human use at a lower cost than other methods
- (2) produce pathogens that are able to live in humans
- (3) clone human cells with desired characteristics
- (4) eliminate the need for laboratory production of medicines for humans

- 12 DNA is able to control cellular activities most directly by regulating the process of
- (1) meiotic division
  - (2) protein synthesis
  - (3) active transport
  - (4) selective breeding
- 13 Which statement describes an effect of natural selection on a species?
- (1) It favors the survival of certain members of the species and results in a change in the proportion of individuals with highly adaptive traits.
  - (2) It provides feedback mechanisms for members of a species and results in a change in the proportion of individuals with homeostatic controls.
  - (3) It leads to reproduction with other species, increasing the number of different adaptations.
  - (4) It increases competition between populations that occupy different niches, increasing the chance of extinction of the less-adapted species.
- 14 Maple leaf beetles and willow leaf beetles are named for the type of tree where they live and reproduce. They look identical to each other when observed, but experiments have shown that willow beetles would starve before eating maple leaves. This is an example of specialization that would directly reduce
- (1) variation
  - (2) competition
  - (3) adaptation
  - (4) replication
- 15 Which event would most likely cause a change in a genetic sequence in an organism?
- (1) eating certain foods high in saturated fats
  - (2) strenuous physical activity
  - (3) exposure to radiation
  - (4) a sudden exposure to cooler temperatures
- 16 During the process of cellular respiration, energy is released from
- (1) carbon dioxide
  - (2) oxygen atoms
  - (3) water molecules
  - (4) chemical bonds
- 17 A new vaccine was developed and then tested on a large sample of individuals. This new vaccine will be considered effective if it helps prepare the body to fight future invasion by
- (1) inhibiting the response of red blood cells
  - (2) stimulating the reproduction of microbes
  - (3) inhibiting the action of immune cells
  - (4) stimulating the production of antibodies
- 18 Which expression correctly represents a reproductive process that usually occurs in humans where  $2n$  is equal to the number of chromosomes in each body cell?
- (1)  $n + n \rightarrow n$
  - (2)  $n + n \rightarrow 2n$
  - (3)  $n + 2n \rightarrow 2n$
  - (4)  $2n + 2n \rightarrow 4n$
- 19 One effect of uncontrolled diabetes is that the blood might develop an acidic pH. As a result, cells may not be able to regulate their internal pH. Within these cells, this could cause a disruption of the function of biological catalysts known as
- (1) enzymes
  - (2) toxins
  - (3) antibodies
  - (4) antigens
- 20 A Native American saying states that, "We do not inherit the land we live on from our grandparents, we borrow it from our grandchildren." This saying is an attempt to make us understand that
- (1) the impact we have on the environment lasts for many generations
  - (2) we must pay a lot of money to buy land from our parents
  - (3) what we do today to the environment has little impact on our children
  - (4) human actions only affect other humans
- 21 Cells of the immune system are able to respond to the presence of invading organisms because they recognize the
- (1) antigens present on the invaders
  - (2) antibodies present in invading pathogens
  - (3) DNA pattern in the nuclei of viruses
  - (4) antibiotics released from microbes

22 Typhoid fever, a disease that causes headaches, digestive upset, and a high fever, is caused by the bacterium *Salmonella typhi*. Typhoid can be spread from person to person by contaminated water or food or by a lack of cleanliness. Since the 19th century, the number of individuals infected with this disease has decreased. Which statement best explains why the number of people with this disease and other bacterial diseases has decreased over the last 100 years?

- (1) Scientists have corrected the damaged genes that cause typhoid fever and other infectious diseases.
- (2) Public health officials have placed better controls on the use of the toxic substances that cause these diseases.
- (3) Typhoid fever, like most other bacterial diseases, is often caused by a lack of proper nutrition.
- (4) Personal habits, such as hand washing, have greatly reduced contamination from bacteria.

23 Deforestation most directly results in

- (1) an increase in oxygen in the atmosphere
- (2) a decrease in soil erosion
- (3) a decrease in biodiversity in the area
- (4) an increase in the absorption of carbon dioxide

24 In the California Mojave Desert, an energy company is building a large solar-power facility. It is expected to produce enough power for 140,000 homes and also cut carbon dioxide emissions by 500,000 tons a year. The facility will be built on 4,050 acres of wildlife habitat, which is near a protected refuge for a species of desert tortoise. The decision to build this power plant is most likely based on

- (1) proving that positive atmospheric changes are less important than preserving wildlife
- (2) a trade-off, weighing the need for a cleaner energy source versus the protection of a natural resource
- (3) the fact that building these solar-power energy plants disrupts wildlife habitats
- (4) providing evidence that technological advances always produce positive environmental impacts

25 As a result of human activity, a significant percentage of the coral reefs in the oceans have been damaged. One-third of marine fish species depend on coral reefs for survival. Many of these fish might die. The most direct cause of the death of these fish would be

- (1) habitat destruction
- (2) direct harvesting
- (3) recycling of nutrients
- (4) use of nuclear fuels

26 Which statement best describes the role of decomposers?

- (1) They convert carbon dioxide and water to glucose.
- (2) They break down organic compounds into products used by other organisms.
- (3) They release oxygen to the atmosphere.
- (4) They provide energy for the synthesis of proteins.

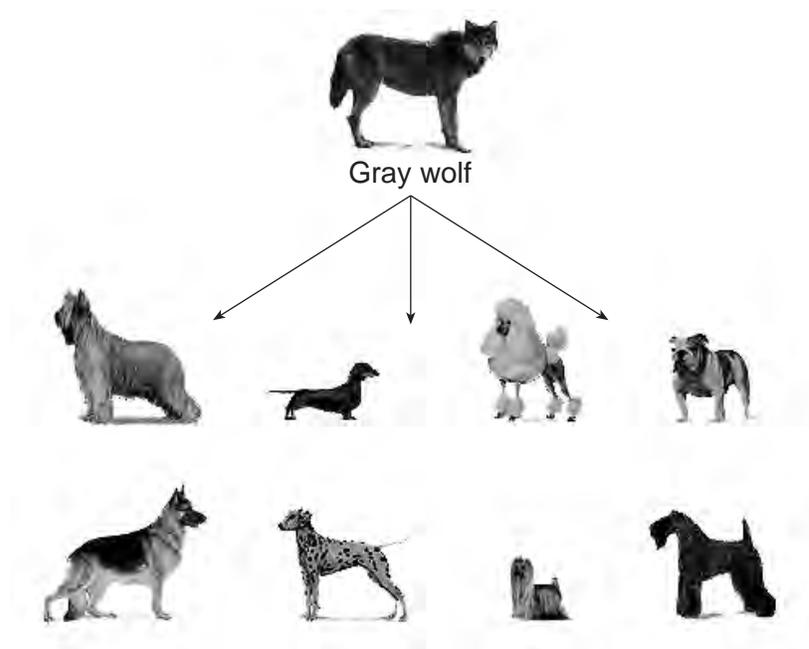
27 Many scientists are worried about some of Earth's finite resources because humans are

- (1) using carbon dioxide faster than it is being produced
- (2) placing industrial wastes in landfills
- (3) interfering with energy flow from consumers to producers
- (4) using large amounts of some materials that cannot be renewed

28 Many communities have started programs to dispose of evergreen trees after the holiday season. These programs allow individuals to bring these trees to be shredded, and the resulting chips are spread around parks and recreational areas as mulch. These programs benefit the environment by

- (1) increasing pollution in parks
- (2) taking up more space in landfills
- (3) returning materials to the environment
- (4) increasing carbon dioxide in the atmosphere

29 Modern dogs are direct descendants of the gray wolf. They first appeared about 130,000 years ago. Today, there are about 150 different breeds of domestic dog, a few of which are shown below.



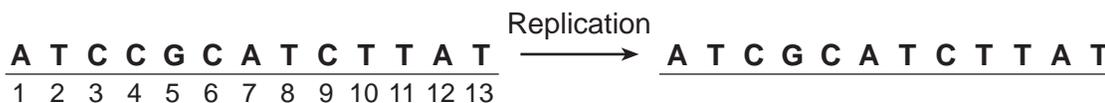
All modern domestic dogs are descendants of the gray wolf.

adapted from: [www.pbs.org](http://www.pbs.org)

The great variety of modern dogs can best be explained by

- (1) selective breeding of dogs over many years
- (2) the cloning of domestic dogs
- (3) genetic alterations in gray wolves alive today
- (4) natural selection favoring wolves over dogs

30 The diagram below shows an alteration that occurred during the replication process of a portion of a gene. The numbers identify the locations of specific bases in the sequence.



This alteration is most likely the result of

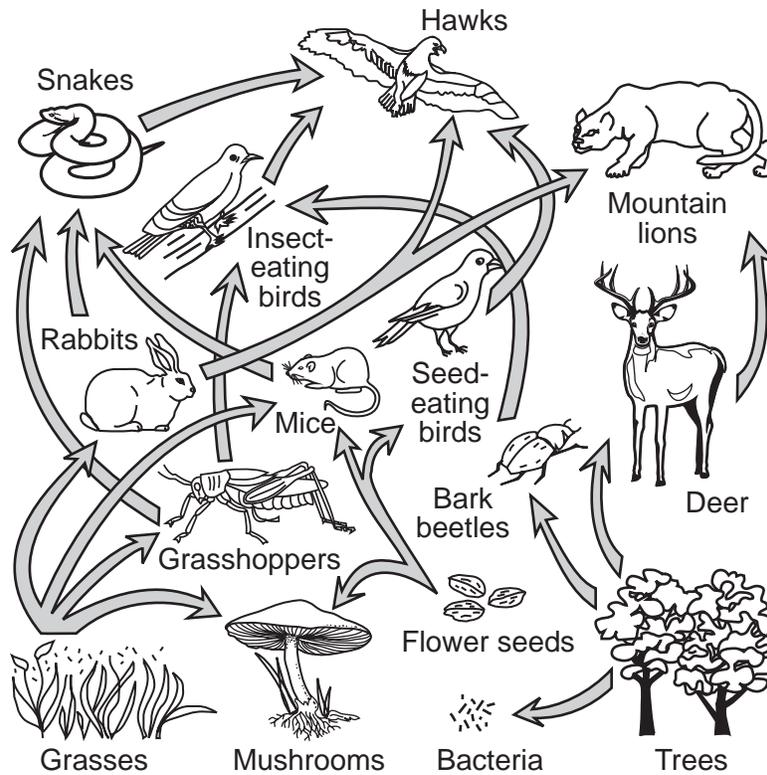
- (1) a substitution at base 2
- (2) a deletion of base 2
- (3) an insertion of base 3
- (4) a deletion of base 4

**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.

Base your answers to questions 31 and 32 on the diagram below and on your knowledge of biology. The diagram represents a food web.



31 What do the arrows in the diagram represent?

- (1) an increase in population
- (2) the evolution of organisms
- (3) the flow of energy
- (4) ecological succession

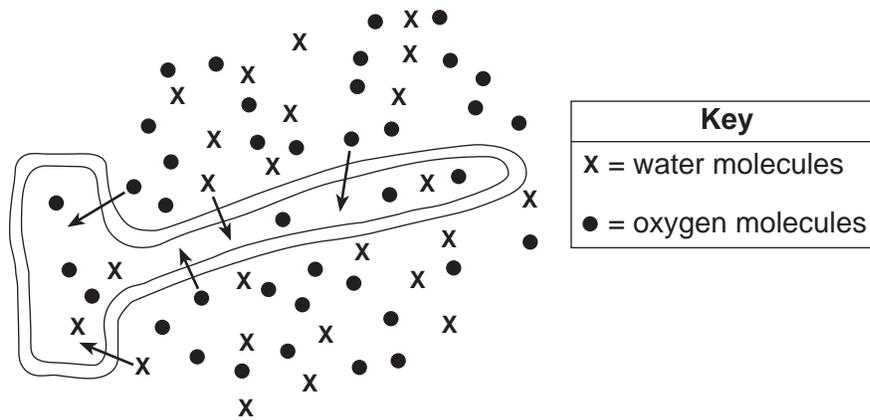
32 Which statement correctly describes interactions between organisms in this ecosystem?

- (1) Hawks are predators of insect-eating birds, but not of seed-eating birds.
  - (2) Hawks and snakes prey on both rabbits and grasshoppers.
  - (3) Rabbits and mice compete for both grasses and flower seeds.
  - (4) Grasshoppers and mice compete for grasses, but not flower seeds.
-

33 Humans have altered ecosystems by activities that are sometimes deliberate and sometimes accidental. In the United States, humans have altered ecosystems by introducing invasive species that outcompete native species. Which activity resulted in the accidental introduction of an invasive species?

- (1) importing Japanese knotweed because it has an attractive flower
- (2) transporting zebra mussels to the Great Lakes by discharging water taken on in European ports to stabilize large ships
- (3) releasing Chinese mitten crabs in the Hudson River to establish them as a food source
- (4) planting purple loosestrife that was brought here from Europe as a source of medicine

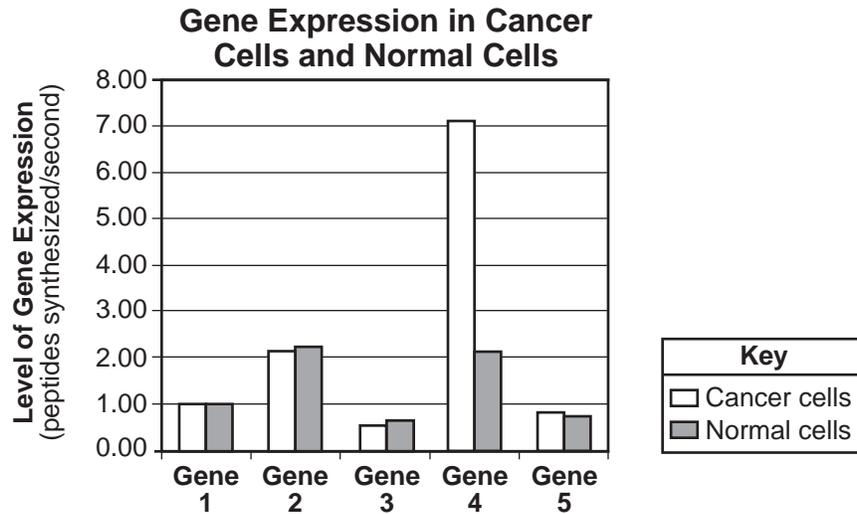
34 The diagram below represents a specialized cell located in the root of a plant. The arrows in the diagram indicate the movement of molecules of oxygen and water into the cell.



Which row in the chart below correctly identifies the process responsible for the movement of each type of molecule represented in the diagram?

Row	Water	Oxygen
( 1 )	diffusion	active transport
( 2 )	diffusion	diffusion
( 3 )	active transport	diffusion
( 4 )	active transport	active transport

Base your answer to question 35 on the graph below and on your knowledge of biology. The graph shows the level of gene expression of five different genes in normal and cancerous cells.



- 35 Which statement is a valid inference that can be made based on the data in this graph?
- (1) The change in the level of gene expression in gene 4 could indicate it plays a major role in the development of cancer.
  - (2) Slight decreases in gene expression will always result in the formation of cancer cells.
  - (3) Cells will develop cancer if the gene expression of these five genes remains below four peptides per second.
  - (4) An increase in the level of gene expression in these five genes is necessary for cancer to develop in cells.
- 
- 36 The cells of some organisms contain both chloroplasts and mitochondria. Which statement describes what would happen in these cells if they were moved from a light environment to a dark one?
- (1) The amount of oxygen present would decrease and the amount of carbon dioxide would increase.
  - (2) The amount of glucose present would increase and ATP would no longer be available.
  - (3) The amount of carbon dioxide present would decrease and ATP would continue to be synthesized.
  - (4) The amount of oxygen present would increase and the amount of glucose available would decrease.

37 In the spring of 2010, there was a catastrophic explosion on an ocean oil drilling rig, causing millions of gallons of oil to be released into the Gulf of Mexico. Many organisms died due to the thick sludge in their habitat. However, in some organisms, such as shellfish, the oil stuck to tissues inside their shells. Which statement expresses a major concern of environmentalists about the accumulation of the oil in certain organisms in the Gulf of Mexico ecosystem?

- (1) Larger organisms eat the shellfish and more chemicals will build up in their tissues.
- (2) The shellfish will prevent other organisms from obtaining oil.
- (3) Smaller organisms will be unaffected by the chemicals.
- (4) Larger organisms will be less affected by the oil, because they can eat other organisms.

Base your answers to questions 38 and 39 on the information and data table below and on your knowledge of biology.

Fertilized eggs containing embryos from the same species of alligator were incubated at different temperatures. The sex of the hatched offspring is shown in the table below.

**Sex of Offspring Incubated at Different Temperatures**

	Temperature of Egg Incubation					
	26°C	28°C	30°C	32°C	34°C	36°C
<b>Number of Eggs Used</b>	100	100	100	100	100	100
<b>Number of Embryos that Died</b>	80	4	3	2	6	86
<b>Number of Females Hatched</b>	20	96	97	85	0	0
<b>Number of Males Hatched</b>	0	0	0	13	94	14

38 A review of this data could lead to the conclusion that

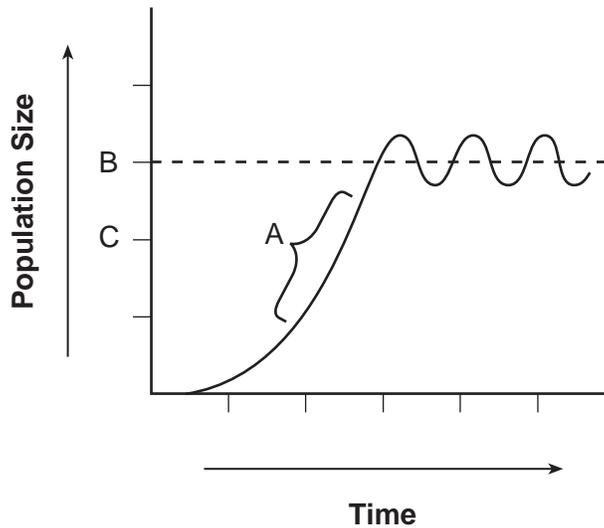
- (1) the most alligator eggs hatched if incubated at 26°C
- (2) the sex of the offspring depends on the incubation temperature
- (3) female alligators develop at higher temperatures
- (4) temperature doesn't affect the survival of alligator embryos

39 The percent of surviving females at 32°C from the original number of eggs incubated was

- (1) 13%
- (2) 2%
- (3) 85%
- (4) 98%

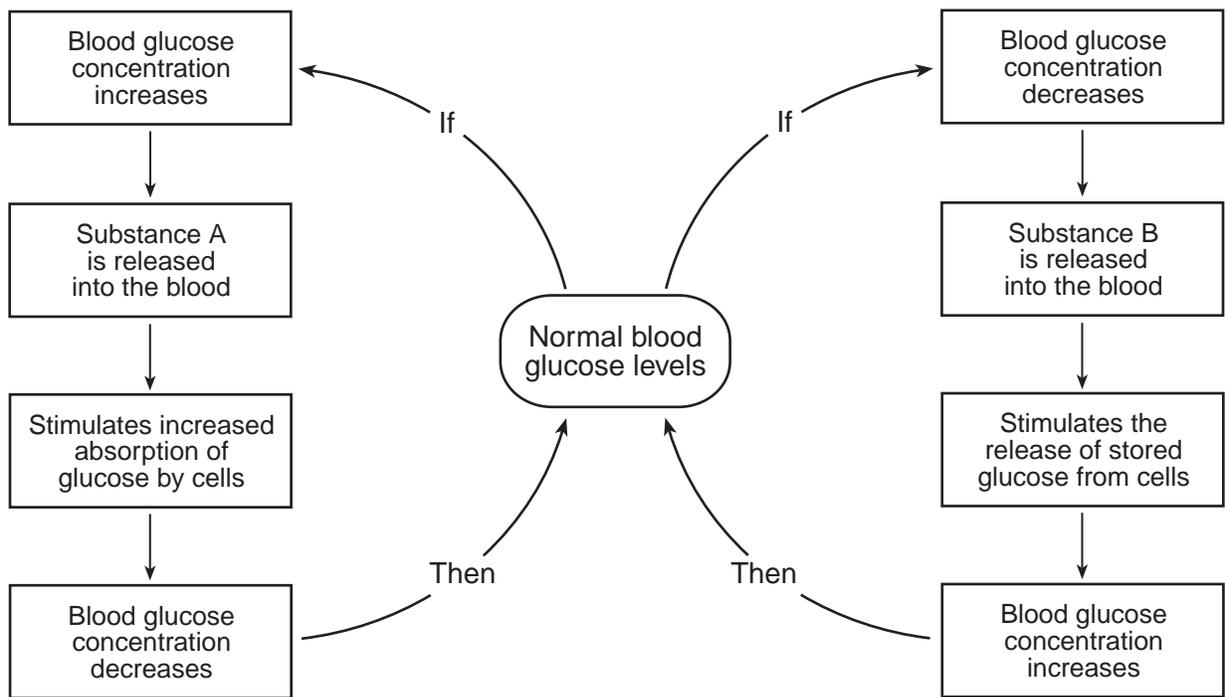
Base your answers to questions 40 and 41 on the graph below and on your knowledge of biology. The graph shows the growth of a population of rabbits in a specific ecosystem.

**Rabbit Population in a Specific Ecosystem**



- 40 Which environmental factor could have caused the change indicated at A?
- (1) increased predation by herbivores
  - (2) increased availability of food
  - (3) increased number of decomposers
  - (4) increased competition among carnivores
- 41 Over a period of time, the location of the dashed line would move from location B to location C on this graph if
- (1) the birthrate of the rabbit population was equal to the death rate of the rabbit population
  - (2) there was a decrease in the number of rabbit predators and an increase in the availability of plants
  - (3) there was a decrease in the availability of minerals, water, and shelter
  - (4) the entire rabbit population migrated to a new ecosystem containing more autotrophs
-

Base your answers to questions 42 and 43 on the diagram below and on your knowledge of biology. The diagram represents the effect of two chemical substances, *A* and *B*, in maintaining the level of glucose in the blood in humans.



42 The interaction of substances *A* and *B* is an example of

- (1) a genetic mutation
- (2) homeostatic feedback
- (3) an immune response
- (4) active transport

43 Which statement is correct regarding the substances involved in these interactions?

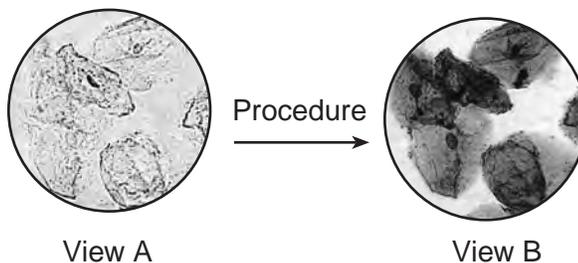
- (1) Substance *A* is insulin, which is released by cells in the pancreas.
- (2) Substance *B* is a chemical receptor molecule produced by blood cells.
- (3) Both substances *A* and *B* are classified as biological catalysts.
- (4) Substance *A* is a chemical that is produced by specialized blood cells.

**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.

44 Two views through a compound light microscope of a wet-mount slide preparation of cells are shown in the photographs below.



Which procedure was most likely followed to obtain view B? [1]

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**GO ON TO THE NEXT PAGE** ⇨

Base your answers to questions 45 through 47 on the data table below and on your knowledge of biology. The data table shows the concentration of estrogen in picograms per milliliter (pg/mL) in the blood of a woman over the course of 28 days.

### Estrogen Concentration in Blood

Day	Concentration of Estrogen (pg/mL)
1	30
5	80
10	200
15	180
20	30
28	25

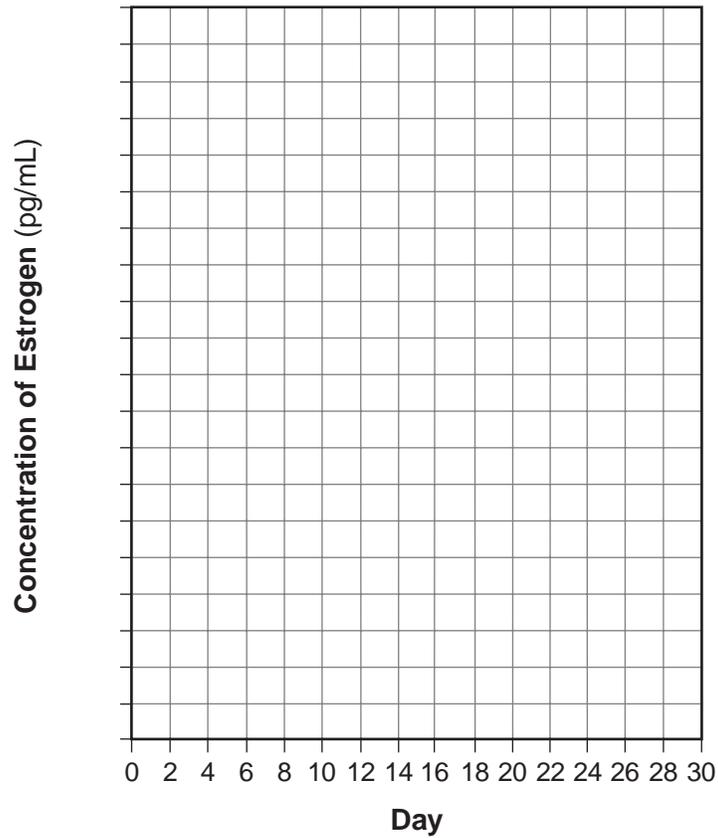
*Directions (45–46):* Using the information given in the data table, construct a line graph on the grid following the directions below.

45 Mark an appropriate scale, without any breaks, on the axis labeled “Concentration of Estrogen.” [1]

46 Plot the data for concentration of estrogen on the grid. Surround each point with a small circle and connect the points. [1]



**Estrogen Concentration in Blood**



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

47 The concentration of estrogen at day 8 is closest to

- (1) 28 pg/mL
  - (2) 80 pg/mL
  - (3) 150 pg/mL
  - (4) 200 pg/mL
-

Base your answers to questions 48 and 49 on the word equations below and on your knowledge of biology. The equations represent two biochemical processes that occur in living organisms. The letter *X* represents a molecule produced from process 1.

Process 1: oxygen + glucose  $\rightarrow$  carbon dioxide + water + *X*

Process 2: carbon dioxide + water  $\rightarrow$  oxygen + glucose

48 Identify the molecule represented by letter *X* in process 1. [1]

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

49 Which process occurs in the cells of a green plant leaf?

(1) process 1, only

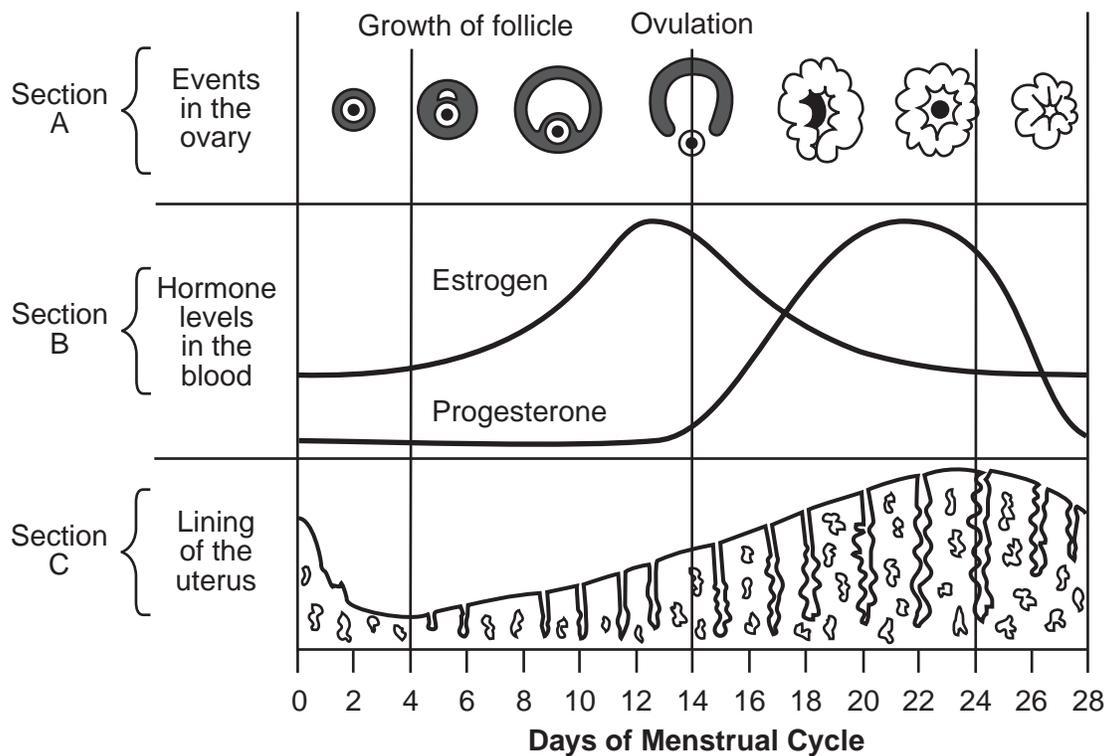
(2) process 2, only

(3) neither process 1 nor process 2

(4) both process 1 and process 2

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Base your answers to questions 50 through 53 on the graph below and on your knowledge of biology. The graph shows some events associated with the reproductive cycle of human females.



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

- 50 Which sections of the graph represent structures affected directly by the hormones shown?
- (1) section A and section B, only
  - (2) section B and section C, only
  - (3) section A and section C, only
  - (4) section A, section B, and section C

51 According to the graph, on which day is the egg released from the ovary? [1]

Day: \_\_\_\_\_

52 Which section of the graph shows the location where the zygote would most likely become implanted and develop? [1]

Section: \_\_\_\_\_

53 Identify another human reproductive hormone that is *not* shown on this graph. [1]

\_\_\_\_\_

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

Different plant species require different amounts of direct sunlight in order to flower. A student designed an experiment to determine the length of exposure to direct sunlight necessary for a specific plant species to produce flowers. The student collected the data below.

- 0 hours, 0% with flowers; 9 hours, 0% with flowers
- 1 hour, 0% with flowers; 5 hours, 90% with flowers
- 3 hours, 80% with flowers; 7 hours, 10% with flowers

54 Organize the data collected, from shortest to longest length of exposure, in the data table below. [1]

**Relationship of Sunlight Exposure to Flower Production**

<b>Hours of Exposure to Direct Sunlight</b>	<b>Percent of Plants with Flowers</b>

55 At the end of the experiment, the student stated that if plants are exposed to more hours of daylight, they will always produce a greater percentage of flowers. Is this a valid conclusion? Support your answer. [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 answers to questions 56 and 57 on the information below and on your knowledge of biology.

### Decline in the Amphibians

Declines in amphibian species, such as frogs, toads and salamanders, might affect the ways in which ecosystems function. Amphibians prey on many types of small organisms that survive by consuming leaf litter (leaf material on the ground of ecosystems). These small organisms include animals such as earthworms, centipedes, millipedes, pill bugs, and many species of insects. In turn, amphibians are preyed on by fish, herons, chipmunks, turkeys, foxes, coyotes, and other animals.

Human activities often cause a reduction in the size of amphibian populations. As amphibian populations are reduced, the organisms that are preyed on by amphibians increase in number. As the populations of small forest organisms increase, the amount of leaf litter decreases. The decrease in the amount of leaf litter on the forest floor may have negative effects on the forest ecosystem.

- 56 Identify *one* human activity and describe how that activity could directly or indirectly lead to a reduction in amphibian populations. [1]

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- 57 State *one* possible effect an increase in the amount of leaf litter on the forest floor would have on the amphibian population. Support your answer. [1]

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Base your answers to questions 58 and 59 on the information below and on your knowledge of biology.

**Female Shark Reproduced Without Male DNA, Scientists Say**

A hammerhead shark that gave birth in a Nebraska aquarium reproduced without mating, a genetic analysis shows.

This form of asexual reproduction, called parthenogenesis, has been found in other vertebrate species, including some snakes and lizards. But this is the first time it has been documented in a shark...

Instead, the female shark's own genetic material combined during this process of cell division that produces an egg. A cell called the secondary oocyte, which contains half the female chromosomes and normally becomes the egg, fused with another cell called the secondary polar body, which contains the identical [amount of] genetic material....

Robert E. Hueter, director of the Center for Shark Research at the Mote Marine Laboratory in Sarasota, Fla., said the finding helped fill a gap in understanding parthenogenesis, which has been found to occur in most vertebrate lines except mammals, and until now, cartilaginous fishes like sharks....

"It's a last-resort tactic that animals use when they absolutely can't find another mate," Dr. Hueter said.

Source: Henry Fountain, *The New York Times*, May 23, 2007

58 State why parthenogenesis is considered a form of asexual reproduction. [1]

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59 Explain why parthenogenesis could prove to be harmful to the survival of this species if it were the only method of shark reproduction. [1]

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

Ticks, such as deer ticks and dog ticks, feed on the blood of humans and other animals. Part of the feeding process involves the tick injecting its saliva to help make blood flow. In the process, they sometimes spread disease organisms to their host. Sometimes ticks get on clothing, and can remain there for a few days before actually biting their host.

A scientist found that ticks might be able to survive even when exposed to hot water and detergent in a washing machine.

Students designed the experiment below to test how well ticks survive a hot-water washing machine cycle with detergent. Note that some details of the design are incorrect.

<b>Hypothesis:</b> Can ticks survive a hot water and detergent wash cycle in a washing machine?	
<b>Data to be Collected:</b>	Number of ticks surviving the cold-water wash cycle

	<b>Control Group</b>	<b>Experimental Group</b>
<b>Test Subjects:</b>	deer tick	dog tick
<b>Experimental Setup:</b>	ticks in washing cycle with cold water and detergent	ticks in washing cycle with hot water and detergent
<b>Number Used:</b>	10	100

60 Identify *one* error with the hypothesis. [1]

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61 Explain why the students' proposed data to be collected would not likely test what the students intended. [1]

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62 Identify *one* error in the students' design in the shaded area of the table and explain how the students should change the experiment to correct the error. [1]

Error: \_\_\_\_\_

Correction: \_\_\_\_\_

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Base your answers to questions 63 through 66 on the passage below and on your knowledge of biology.

### The Return of the Large Blue Butterfly

In 1979, the Large Blue Butterfly was declared extinct in the United Kingdom, despite the efforts to protect the grasslands where it lived.

Research into the butterfly life cycle discovered the following facts. The butterflies lay their eggs on flowering thyme plants, and the caterpillars fall to the ground after they hatch. The young butterfly caterpillars have a “honey gland” on their posterior end, which, when stimulated by red ants, makes the caterpillars smell and wiggle like red ants. The red ants treat the butterfly caterpillars as ant grubs and carry them to their underground homes. The red ants keep looking after them and guard them, even though the caterpillars eat ant grubs for 10 months before flying away as adult butterflies in the spring.

The red ants live in fields of short grass. The grass is short enough to let the sun warm the soil. This is where the ants find and eat insects and plants. Rabbits had kept the grass short until the mid-1950s, when the rabbit populations were suddenly devastated by a viral disease. Additionally, farmers allowed pastures to get overgrown by not letting cattle graze on the grass. The red ants vanished when the taller grass increased the shade and cooled the soil.

A program was introduced to protect the pastures where the red ants nested. Their numbers came back. Populations of Large Blue Butterflies from Sweden were brought into the area, and now the Large Blue Butterfly is thriving again.

63 Describe *one* way humans have *negatively* influenced the ecosystem of the red ant. [1]

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64 Describe *one* adaptation present in the butterfly caterpillars that enables the Large Blue Butterfly to survive. [1]

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65 In the space below, construct a food chain consisting of *at least three* organisms, including a producer, that would be present in the ant ecosystem. [1]

66 Select *one* organism from the food chain you constructed and write it on the line below. State *one* way the removal of the organism you selected would affect another organism in the food chain. Support your answer. [1]

Organism: \_\_\_\_\_

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Base your answers to questions 70 and 71 on the information below and on your knowledge of biology.

*Plasmodium*, the world's most lethal parasite, causes malaria. The parasite enters the bloodstream through a mosquito bite, hiding in the human liver before invading red blood cells. Ultimately, millions of infected blood cells explode at once, causing fever and death in 3 million people a year worldwide.

Source: Zimmer, February 12, 2001, "Animal Parasites – As Gross As It Gets," "Science World," pg 11.

70 State *one* reason why *Plasmodium* is considered a parasite of humans. [1]

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71 State *one negative* impact on humans when the use of pesticides for mosquitoes is decreased. [1]

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72 If a large quantity of herbicide, a chemical that is designed to kill weeds, were accidentally spilled into a large lake, it could endanger all the organisms living in the lake. State *one* way the effects of killing the weeds in the lake could be destructive to populations of fish and other animals. [1]

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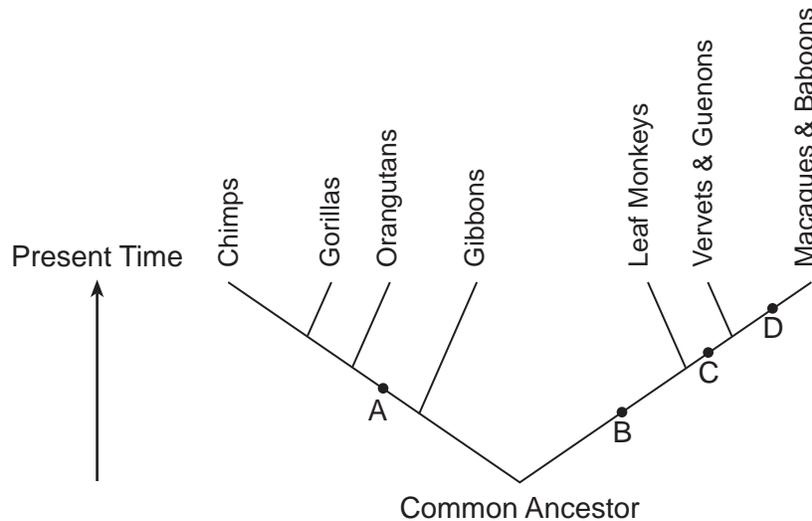
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## Part D

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.

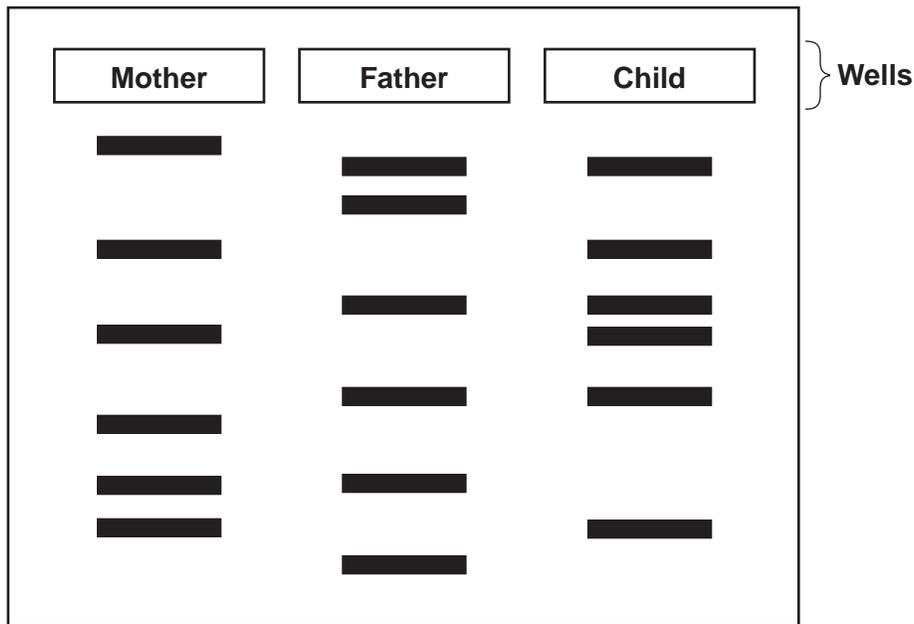
Base your answers to questions 73 and 74 on the diagram below and on your knowledge of biology. The diagram represents evolutionary relationships among some primates.



**Note: The answers to questions 73 and 74 should be recorded on your separate answer sheet.**

- 73 Which statement best describes a relationship between the common ancestor and the other organisms in the diagram?
- (1) The common ancestor most likely has segments of its DNA that will match each of the other organisms'.
  - (2) The common ancestor is more closely related to macaques than to gibbons.
  - (3) Orangutans and gorillas have exactly the same DNA as the common ancestor.
  - (4) Chimps and baboons were the first organisms to evolve from the common ancestor.
- 74 A line representing an organism that is closely related to leaf monkeys and that evolved at about the same time as the gibbons would be drawn beginning at point
- (1) A
  - (2) B
  - (3) C
  - (4) D
-

75 The parents of a new baby believe they brought the wrong child home from the hospital. Gel electrophoresis was performed using DNA samples from the parents and the child. A section of the gel electrophoresis results is shown below.



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

Which conclusion is valid based on the gel electrophoresis results?

- (1) They have the correct child, because her genetic information is identical to that of the father.
- (2) They have the wrong child, because her genetic information does not match that of either parent.
- (3) They have the correct child, because her genetic information came from both parents.
- (4) They have the wrong child, because her genetic information matches only that of the mother.

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

76 The extremes of dry and wet weather of the Galapagos Islands cause the food supply to constantly change. During dry years, the food is mainly large, hard seeds, and finches with large beaks are found in greater numbers.

Which statement best explains this observation?

- (1) Dry environments cause mutations in finches.
- (2) Finches grow larger when they have more water.
- (3) Small finches become smaller during dry seasons.
- (4) Large beak size is an adaptation to dry conditions.

Base your answers to questions 77 and 78 on the information below and on your knowledge of biology.

Three students took their pulse rates in beats per minute (bpm) while sitting in class. The results are shown in the data table below.

**Pulse Rates of Three Students**

<b>Student</b>	<b>Pulse Rate (bpm)</b>
1	73
2	85
3	67

77 State *one* reason why the pulse rates were *not* the same for all three students, even though they were all resting at the time. [1]

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78 What is the average pulse rate, in bpm, for this group of students? [1]

\_\_\_\_\_ **bpm**

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

In an experiment, three plants of the same species were grown in each of six identical pots. The heights of the plants were measured when growth began. Each of the pots was watered every day with salt solutions of different concentrations. The data for the experiment are shown in the table below.

**Effect of Salt Solution on the Height of Plants**

<b>Plant Group</b>	<b>Percent Salt Solution Used for Watering the Plants</b>	<b>Average Initial Height (centimeters)</b>	<b>Average Final Height (centimeters)</b>
A	0	2	30
B	1	2	28
C	2	3	15
D	3	2	10
E	4	3	(died)
F	5	3	(died)

79 State the effect of increasing the percent of salt in the solution used to water the plants on the average final height of the plants in groups A through D. [1]

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80 State *one* way diffusion was involved in the cause of death of the plants in groups E and F. [1]

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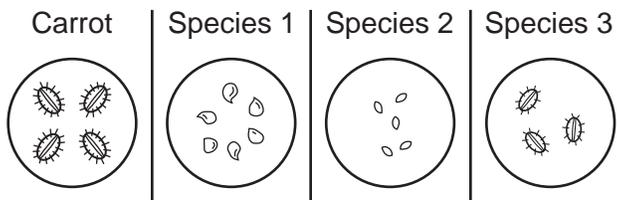
**Note: The answer to question 81 should be recorded on your separate answer sheet.**

- 81 In an experiment to determine the effect of exercise on pulse rate, a student checks his pulse rate before and after exercising for several minutes. The purpose of checking his pulse rate before exercising is that it
- (1) serves as the conclusion for the experiment
  - (2) is needed to justify the sample size
  - (3) serves as a control for the experiment
  - (4) is needed to formulate a hypothesis

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

- 82 What is an advantage of a change in pulse rate after exercising?
- (1) The heart needs to produce more energy to supply the active muscle cells and maintain homeostasis.
  - (2) An increased blood flow carries excess waste products away from the active muscle cells.
  - (3) The blood is removing oxygen from muscle cells that were not active and carrying it to muscle cells that are active.
  - (4) The blood is supplying the active muscle cells with carbon dioxide to neutralize wastes in those cells.

- 83 The diagrams below represent seeds taken from a carrot plant and seeds taken from plant species 1, 2, and 3.



Which species would be expected to be most similar to the carrot? Support your answer. [1]

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- 84 Other than having a variation in beak characteristics, describe another variation in a finch species that could promote survival of an individual bird. Support your answer. [1]

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- 85 Identify or describe *one* tool used in “The Beaks of Finches” lab, and explain why the special features of this beak represented *either* an advantage or a disadvantage in the competition. [1]

Tool: \_\_\_\_\_

Advantage or disadvantage: \_\_\_\_\_

Explanation: \_\_\_\_\_

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