Large-Type Edition

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Tuesday, June 17, 2025 — 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 available for you to use while taking this examination.

DO NOT START THIS EXAMINATION 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 of these components are found in all living organisms?

(1) estrogen and testosterone
(2) insulin and water
(3) chlorophyll and hemoglobin
(4) cytoplasm and ATP

2 Two types of molecules directly involved in cellular communication are

(1) hormones and nerve cell chemicals
(2) fats and carbohydrates
(3) ATP and carbon dioxide
(4) glucose and oxygen

3 When mountain lions consume large prey, they often leave large pieces of their prey behind. The carcass that is left becomes a food source for other organisms. A scientist reported a count of 24,000 beetles in an area where mountain lions had left partially eaten carcasses. Wolves, bears, and other animals also take advantage of the remains of the prey.

The role of the mountain lion in this ecosystem is an example of the concept that

(1) ecosystems require a large number of predators to increase the number of prey
(2) populations are linked with many others in a stable ecosystem
(3) large animals waste food, resulting in harm to other organisms in the ecosystem
(4) predators should consume small prey to protect the diversity of the ecosystem

4 Mutations are an important part of evolution. One reason for this is that mutations

(1) that occur in body cells are passed to offspring
(2) are random events that always increase the ability of members to reproduce
(3) occur only in sexually reproducing organisms
(4) may result in gene variations that provide a survival advantage

5 Ladybugs that eat plant pests are currently raised and sold commercially to gardeners. It was assumed that all of the imported ladybugs would remain within the garden area and consume only the harmful insect pests. It is now known that the ladybugs can travel widely, with one study showing that within a few days, 99% had left the area where they were originally released.

One environmental concern regarding the use of ladybugs to control insect pests could be that

(1) ladybugs are an endangered species and must be collected in the wild
(2) ladybugs are a safer alternative than the use of chemical pesticides
(3) the migration of introduced ladybugs may affect food webs in other areas
(4) the action of ladybugs may reduce insect pest populations

6 The best-adapted individuals in a population are most likely to be successful in passing on their traits to the next generation because

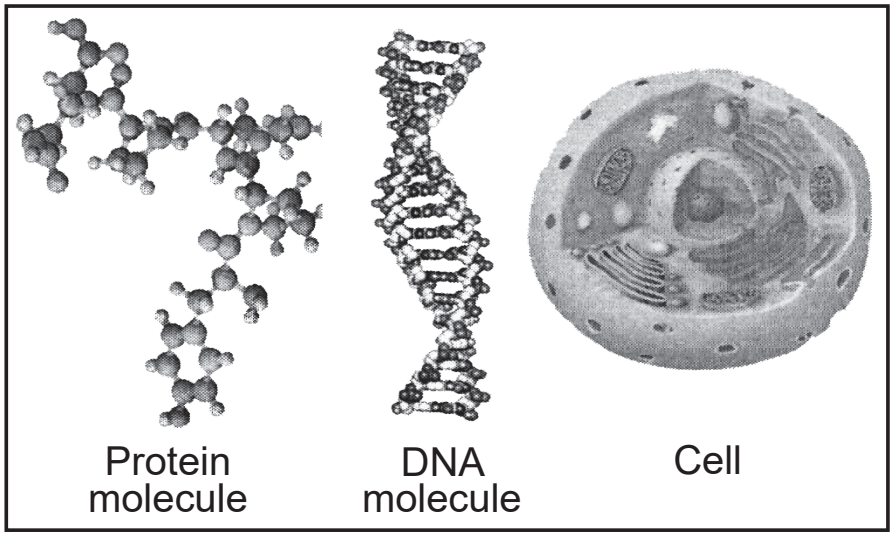
(1) they were able to survive the conditions of their environment when others could not

(2) their offspring will be better able to cope with any environmental changes that may occur

(3) their genes are the strongest, which will help them attract suitable mates

(4) they are less attractive and are less likely to find suitable mates

7 Some structures found in living organisms are shown below.



Which statement best describes the relationship among the three structures?

(1) DNA is produced by large protein molecules that diffuse into the cell.

(2) Protein is composed of DNA that is produced in the cell.

(3) DNA controls the production of protein in the cell.

(4) A cell is composed entirely of DNA and protein.

8 Scientists found that over a period of 300 years, a pond slowly transformed into a meadow and then a forest. During that time, communities of organisms were replaced by different communities.

The best explanation for why new communities were able to replace the older communities is that

(1) the species in the old communities died of disease
(2) the environment gradually changed, making the area less favorable for the old communities
(3) there was a lack of predators for the new communities of organisms
(4) the original species suddenly became extinct

9 Many species of warblers, including the Blackburnian warbler shown below, migrate from Central and South America to New York State, where they breed each summer. Warblers primarily prey on insects and nest in hemlock trees.

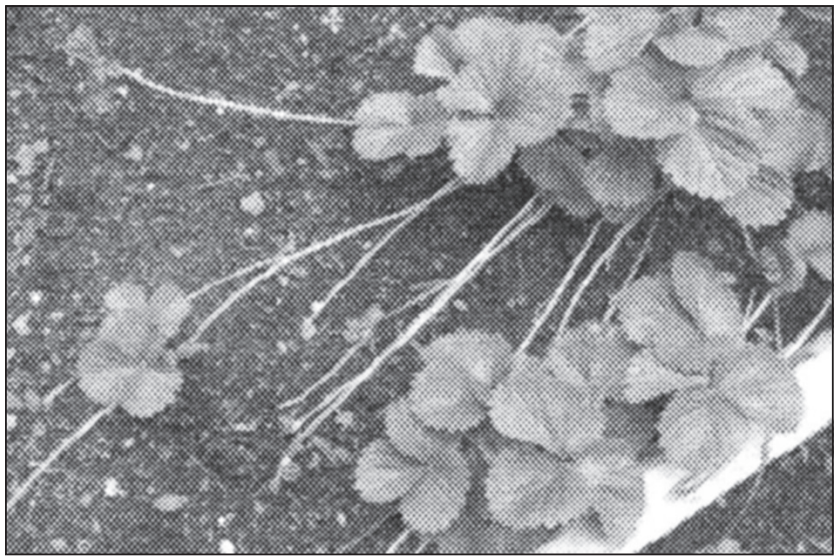
An invasive insect, the wooly adelgid, is killing hemlock trees across the entire state. If this continues, fewer warblers will be able to find suitable nesting sites. One consequence of this may be that

(1) there will be more food for birds that prey on warblers and other small birds
(2) fewer acorns will grow on the oak trees that also grow in the forest
(3) insect pest populations will increase because fewer warblers are present
(4) more warbler eggs will be hatched in Central and South America to increase the population

10 Seagrass populations decrease significantly in size when sea turtles overgraze the area in which the grasses grow. When predators such as sharks have a constant presence in the same area, the turtles leave and the seagrass population increases. This is an example of how organisms

(1) influence other species in a community
(2) balance their basic nutritional needs
(3) maintain their own internal stability
(4) depend on physical conditions for survival

11 Strawberry plants grow runners off of the main parent plant, as shown in the photo below.



New strawberry plants that are genetically identical to the parent plant develop along the runners. This phenomenon can be best explained by the fact that these strawberry plants are produced by

(1) asexual reproduction, and the new plants develop by mitosis and differentiation
(2) sexual reproduction, and the new plants develop by meiosis and fertilization
(3) asexual reproduction, and the new plants develop by meiosis and fertilization
(4) sexual reproduction, and the new plants develop by mitosis and differentiation

12 During a class field trip, a student measured and recorded some abiotic factors present in a pond. Which data did the student most likely include in their record of abiotic factors?

(1) the number of possible food chains and food webs
(2) the diversity of decomposers and their total mass
(3) the temperature and pH of the water
(4) the size and number of fish species

13 Mammals, including humans, dolphins, and cows, produce milk for their young. Surprisingly, researchers have discovered that certain spiders also produce a milk-like fluid for their young. The spider leaves droplets of her "milk" around the nest for the babies after they hatch from their eggs. After one week, the babies will feed on the "milk" directly from her body for at least 20 days.

Which statement best describes this recent discovery?

(1) It proves that all female animals produce the same hormones to make milk.
(2) The discovery will allow for the re-classification of spiders as mammals.
(3) It is an example of parental care for the survival of their offspring.
(4) The discovery confirms that spiders provide mammal milk to their offspring.

14 As part of the "Charge NY" energy plan, New York drivers are being encouraged to purchase electrically powered cars. Many believe that this will help the environment by

(1) reducing the number of cars on the road, since drivers will only be able to go short distances before having to recharge the battery

(2) reducing local air pollution by lowering levels of carbon dioxide and other pollutants

(3) decreasing the number of car sales, since electric cars are more expensive than gasoline-powered cars

(4) decreasing the consumption of fossil fuels, since only renewable energy sources can be used to generate electricity

15 The New Mexico whiptail is a female-only species of lizard that exhibits an unusual form of asexual reproduction. Researchers discovered that these lizards produce eggs that have a full set of chromosomes and have the genetic diversity of sexually reproducing lizards.

Which statement best describes the offspring of these lizards?

(1) The offspring are a result of uniting a male and female gamete.

(2) The offspring develop from eggs with twice the genetic information of the female lizard.

(3) The offspring have cells that contain DNA found only in the female lizard.

(4) The offspring are genetically identical to each other and the female lizard.

16 In humans, the placenta is important to the developing embryo. Which essential life functions are carried out by the placenta?

(1) nutrition, excretion, and reproduction
(2) respiration, nutrition, and excretion
(3) movement, reproduction, and nutrition
(4) coordination, immunity, and movement

17 Injecting individuals with a vaccine composed of killed bacteria protects them from a disease because the proteins from the killed bacteria

(1) serve as food for invading pathogens, which prevents them from feeding on human proteins
(2) bind with cell nuclei, preventing live pathogenic bacteria from binding with the nuclei later
(3) cause a mild case of the disease, preventing the immune system from responding to future infections
(4) stimulate the production of antibodies that can be produced in response to an infection

18 Which statement about amino acids and simple sugars is correct?

(1) Amino acids are used to build inorganic molecules, and simple sugars are used to build organic molecules.
(2) Starches are digested into amino acids, and proteins are digested into simple sugars.
(3) Amino acids and simple sugars are used as building blocks in the synthesis of organic compounds.
(4) Amino acids can enter cells, and simple sugars cannot enter cells.

19 Protein chains may break. This can cause a problem for living cells because

(1) if the proteins break, the cell will contain more proteins than it needs
(2) if the chains break, the amino acids will poison the cell, destroying organelles
(3) the broken proteins will not interact with other molecules correctly
(4) the broken chains will attack the ribosomes of the cell and shut them down

20 Enzymes are essential to maintaining homeostasis and helping to regulate human metabolism. They are also examples of molecules that are

(1) composed of complex carbohydrates
(2) not specific to any life function
(3) synthesized by the cell membrane
(4) influenced by pH

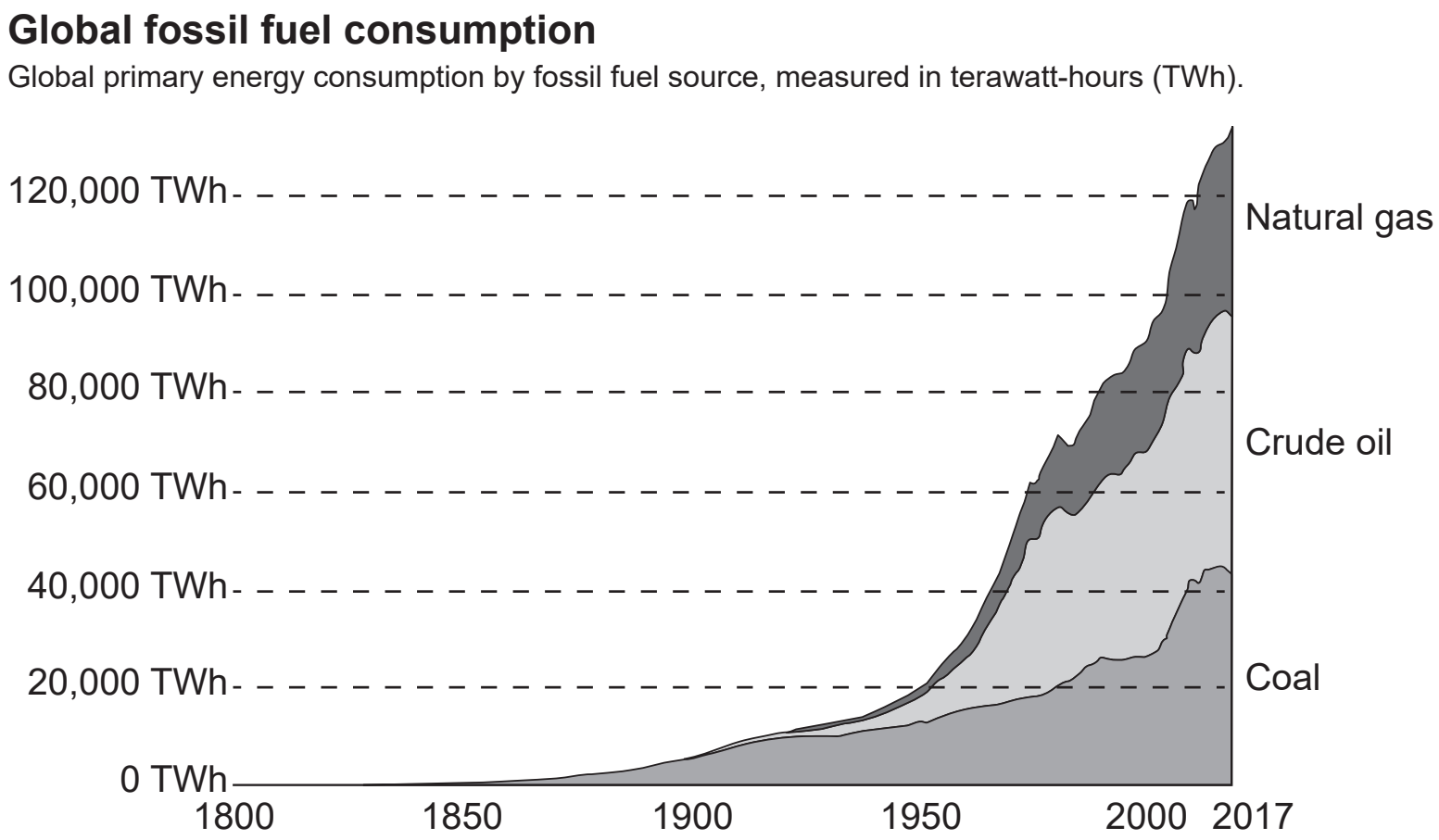
21 The process by which DNA molecules separate and add new molecular bases to form another DNA molecule is called

(1) protein synthesis
(2) cell membrane synthesis
(3) replication
(4) mitosis

22 Which row in the chart below correctly describes activities that occur in each of the two organelles shown?

Row	Chloroplast Activity	Mitochondrion Activity
(1)	uses glucose as it functions	makes glucose as it functions
(2)	makes glucose as it functions	uses glucose as it functions
(3)	uses oxygen as it functions	makes oxygen as it functions
(4)	uses oxygen as an energy source	uses carbon dioxide as an energy source

23 The amount of fossil fuels consumed from 1800 until 2017 is shown in the graph below.



The increased demand for and use of fossil fuels is a direct result of an

(1) increased focus on renewable energy sources
(2) increased concern for environmental stability
(3) increase in atmospheric changes
(4) increase in industrialization

24 Some prescription drugs come with a warning that these drugs should be avoided during the early stages of pregnancy. The reason that pregnant women should avoid certain medications early in their pregnancy is because the drug may

(1) affect the development of organs in the fetus
(2) interfere with meiosis
(3) allow differentiation to occur
(4) interfere with fertilization

25 Lions in East Africa are night hunters. They are most successful during the darker phases of the moon, when they are less visible. Prey animals, such as the wildebeest shown below, are also influenced by the moon cycles and amount of darkness. During the dark phases of the moon, they are less active.

This behavior shows that

(1) predator behaviors are controlled by the carrying capacity of the environment
(2) environmental factors can influence the behavior of predators and their prey
(3) producers directly regulate the number of predators in community
(4) consumers influence the physical factors in the predator's ecosystem

26 The removal of three consecutive base-subunits from a gene would most directly affect the

(1) membrane of a cell
(2) structure of a protein
(3) pH of the cytoplasm
(4) size of a cell nucleus

27 Some medications have been found to damage mitochondria. This can upset metabolism because mitochondria

(1) synthesize energy to make organic compounds
(2) produce carbon dioxide, which is used for cellular respiration
(3) release oxygen, which is necessary for photosynthesis
(4) produce ATP molecules used for cellular processes

28 The Labrador retriever is a breed of dog that is characterized by a solid yellow, brown, or black coat and a friendly personality. In order to increase the chances of Labrador retriever puppies having these traits, breeders should

(1) insert the genes for these traits into the cells of the puppies
(2) increase genetic variation by mating dogs with different traits
(3) breed only dogs with the desired traits to produce puppies
(4) use asexual reproduction to breed dogs with a variety of traits

29 An example of a harmful immune response occurs when immune cells cause the breakdown of

(1) cancerous tissue
(2) bacteria cells
(3) pathogenic viruses
(4) transplanted organs

30 Individuals who use tanning beds have an increased risk of getting skin cancer. Their skin cancer may

(1) be passed to their offspring because it is a gene mutation
(2) spread in the individual but will not be directly passed to their offspring
(3) result in the offspring having immunity to skin cancer
(4) help their offspring better adapt to skin cancer in sunnier climates

Part B–1

Answer all questions in this part. [13]

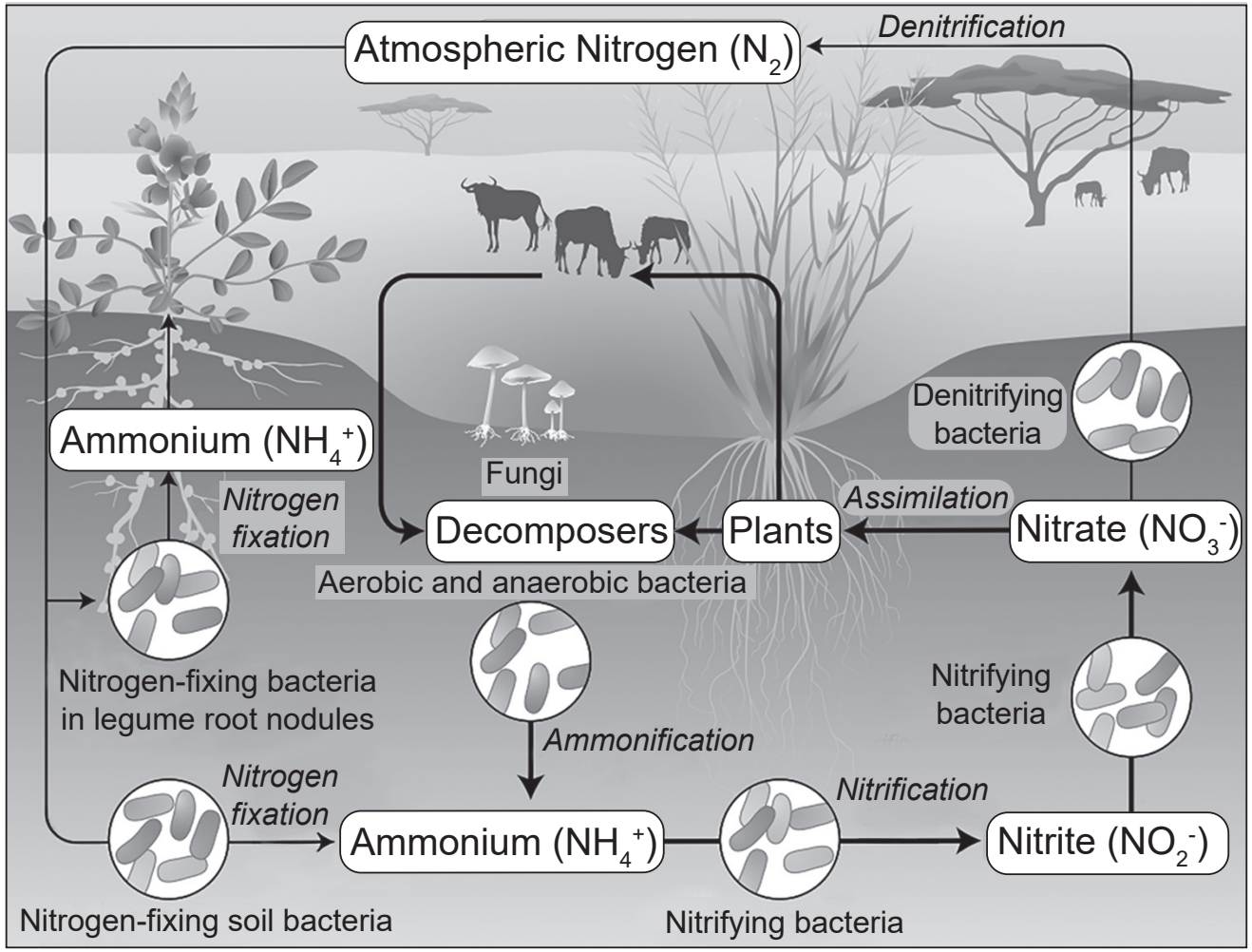
Directions (31–43): For *each* statement or question, record on the separate answer sheet the *number* of the word or expression that, of those given, best completes the statement or answers the question.

Base your answers to questions 31 through 34 on the information and nitrogen-cycling model illustrated below and on your knowledge of biology.

Material cycles are necessary to recycle substances needed and used by organisms in their habitat.

The atmosphere is composed of about 80% nitrogen gas (N_2) that cannot be used by most organisms in that form. It is through the action of many different types of bacteria that the nitrogen gas can be made available to other organisms.

The diagram below represents a model of the nitrogen cycle.


Atmospheric Nitrogen (N_2)
Denitrification
Ammonium (NH_4^+)
Nitrogen fixation
Fungi
Decomposers
Plants
Assimilation
Nitrate (NO_3^-)
Denitrifying bacteria
Aerobic and anaerobic bacteria
Nitrogen-fixing bacteria in legume root nodules
Ammonification
Nitrifying bacteria
Nitrogen fixation
Ammonium (NH_4^+)
Nitrification
Nitrite (NO_2^-)
Nitrogen-fixing soil bacteria
Nitrifying bacteria

GO RIGHT ON TO THE NEXT PAGE ⇨

31 Based on the model, which bacteria are able to convert atmospheric nitrogen gas to nitrogen compounds in the soil?

(1) aerobic and anaerobic bacteria
(2) nitrifying bacteria
(3) nitrogen-fixing bacteria
(4) denitrifying bacteria

32 Based on the model, which two organisms carry out opposite processes?

(1) nitrifying bacteria and nitrogen-fixing bacteria in the soil
(2) nitrogen-fixing bacteria in the soil and nitrogen-fixing bacteria in legumes
(3) aerobic bacteria and anaerobic bacteria
(4) denitrifying bacteria and nitrogen-fixing bacteria in the soil

33 Plants can use nitrates from the soil to make amino acids such as alanine ($C_3H_7NO_2$).

Two other substances plants take in from their environment that would provide all of the components to make many alanine molecules are

(1) carbon dioxide (CO_2) and water (H_2O)
(2) carbon dioxide (CO_2) and sunlight
(3) water (H_2O) and oxygen (O_2)
(4) glucose ($C_6H_{12}O_6$) and oxygen (O_2)

34 If all of the aerobic and anaerobic bacteria indicated as decomposers in the model were lost from this ecosystem, the most likely effect would be

(1) a decrease in the carrying capacity for nitrogen-fixing bacteria
(2) an increase in the number of nitrifying bacteria
(3) a decrease in the carrying capacity for plants
(4) an increase in activity of the nitrifying bacteria

Base your answers to questions 35 and 36 on the information below and on your knowledge of biology.

Male Pacific field crickets make a loud song that travels a long distance to attract females. They use their wings to create the sound. On the island of Kauai, the loud calls not only attract mates, but also a specific fly species. The fly deposits larvae on the cricket. As the fly larvae mature, they eat the cricket from the inside out.

One summer, observers on Kauai noticed that the crickets were unusually quiet. They also noticed that the wings of these quiet crickets were shaped differently. The scientists hypothesized that the wing mutation helped crickets escape the fly. They collected the following data while testing their hypothesis:

Male Pacific Field Crickets

	Without Wing Mutation	With Wing Mutation
Fly Larvae Present	30	1
Fly Larvae Not Present	70	121
Percent With Larvae	30%	0.8%

35 Which statement most accurately describes the relationship between the data and the original hypothesis?

(1) The data support the hypothesis because crickets with the mutation had fewer fly larvae.
(2) The data support the hypothesis because crickets without the mutation had a greater percentage of survivors.
(3) The data do not support the hypothesis because crickets with the mutation had more fly larvae.
(4) The data do not support the hypothesis because crickets with the mutation had a smaller percentage of survivors.

36 Scientists have noticed that crickets with the mutation are still able to attract mates. Based on the data, which prediction is valid if this particular fly remains part of the cricket's environment?

(1) The number of crickets with the mutation will decrease because the trait is beneficial to them.
(2) The number of crickets with the mutation will remain the same because the trait is neither beneficial nor harmful.
(3) The number of crickets with the mutation will increase because the trait gives them an advantage.
(4) The number of crickets with the mutation will increase because the trait is a disadvantage.

For 20 days, two groups of plants, all with stems of the same length, were grown at two different temperatures. These plants normally grow at a temperature of 25°C. All other environmental conditions were the same. The stem lengths of the plants were measured every five days, averaged, and the data recorded in the table below.

Time (days)	**Length of Stem** (mm)	
	Plants in A Grown at 17°C	**Plants in B Grown at 27°C**
1	15	15
5	25	30
10	42	68
15	54	80
20	71	92

37 Scientists claimed that plants growing in the Group *A* experimental setup at 17°C would be likely to survive if the temperature in their natural environment decreased over time to 17°C. Which statement uses data from the table to support this claim?

(1) Plants in *A* survived growing at 17°C in their experimental setup and would therefore be likely to survive.
(2) Plants in *A* require less water. This makes them more likely to survive in cooler temperatures.
(3) Plants in *B* are growing the most rapidly. A temperature of 17°C will not harm them.
(4) Plants in *B* will survive and will grow faster at the cooler temperature.

Sea Otters at Risk

A single-celled parasite is responsible for the death of a large number of sea otters. Scientists have traced the origin of the parasite to multiple sources, including domestic cat feces. Rain washes some litter box wastes, which contain cat feces, into the ocean kelp forests where sea otters live.

38 Failure to properly dispose of contaminated cat litter is an example of

(1) one way sea otters are negatively affecting large numbers of household pets
(2) how humans are preventing a dangerous parasite from reproducing
(3) a human action that inadvertently could alter the equilibrium in an ecosystem
(4) the release of a substance that could result in a rapid growth of the sea otter population

Base your answers to questions 39 and 40 on the information below and on your knowledge of biology.

Lead in the Environment

Soil contaminated with lead is a source of lead exposure in people and is a worldwide health concern. Scientists examined the relationship between exposure to lead in the topsoil and the occurrence of learning difficulties in children. Soil clings to fingers, toys, and other objects. When young children are exposed to lead, they can experience difficulty with remembering, concentrating, and learning.

Lead was used as a gasoline additive until 1996, when it was banned. Emissions from cars and trucks resulted in a buildup of lead in the soil along the side of the road. In a recent study, scientists measured the concentration of lead along sections of the interstate highway system. They then compared the levels of lead in the soil along the side of the road with the number of children in the area experiencing cognitive difficulties. The scientists discovered that where the level of lead in the soil is high, the number of children with learning difficulties is also high.

39 In order to support the claim that lead in the soil can result in learning difficulties in children, the scientists should

(1) repeat the study comparing lead levels in the soils near rivers with those near highways
(2) support the passage of laws to eliminate the use of lead additives in gasoline
(3) determine if high soil concentration of other metals, such as iron, causes learning difficulties in children
(4) determine if there is a correlation between high levels of lead in the soil and in the blood of children with learning disabilities

40 After discovering where lead levels in the topsoil are high, what could parents do to reduce the chances of learning difficulties in their children?

(1) Provide their children with only organic fruits and vegetables.
(2) Have their children wash their hands after playing outside.
(3) Have their children attend school in a different part of the community where lead levels are lower.
(4) Provide their family physician with information about any genetic disorders in the family.

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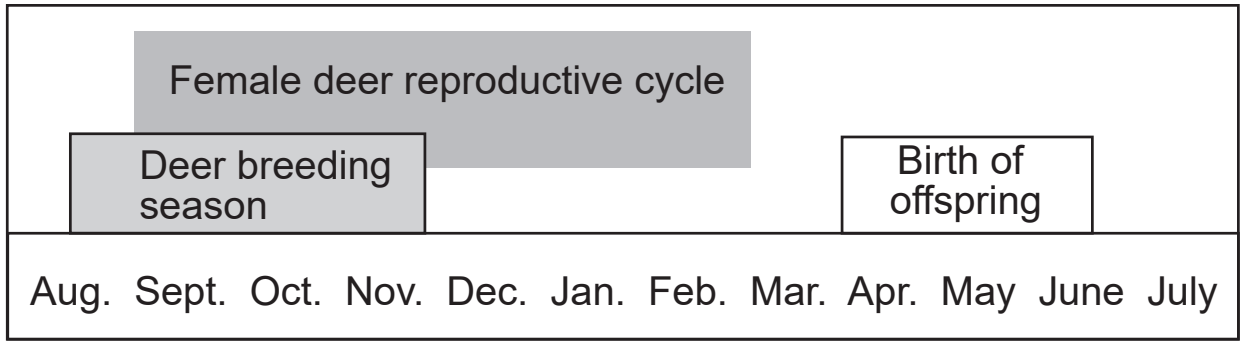
41 Beavers have been migrating north and impacting Arctic ecosystems. By building dams on streams, beavers are creating new bodies of water where there were none. These new bodies of water contribute to the thawing of the frozen permafrost soil, which is a huge natural reservoir of stored greenhouse gases. In a study of beaver dams located on Alaska's Baldwin Peninsula, there was a total of 94 dams in 2010, and by 2019 there was a total of 409 dams.

Based on these numbers of beaver dams constructed between 2010 and 2019, a reasonable claim that scientists can make concerning beaver activity in the Arctic is that beavers

(1) are accelerating the rate of global climate change
(2) are producing a more stable Arctic ecosystem through dam-building
(3) have exceeded their carrying capacity in the Arctic
(4) have caused more soil to freeze during the winter months

42 White-tailed deer in New York State breed once a year. The timing of the breeding season and birth of offspring is represented in the chart below.

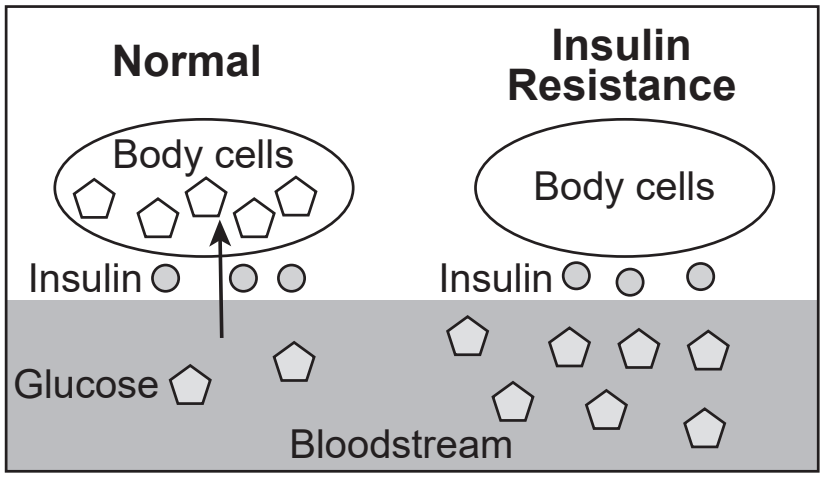
White-Tailed Deer Reproductive Cycle Timeline



Which statement best helps explain why this breeding cycle is successful for deer?

(1) Giving birth in the spring and early summer ensures that there will be food for the offspring.
(2) Deer avoid giving birth during the fall hunting season.
(3) Fall is the only time of the year male and female deer are in the same locations.
(4) Large deer predators move to cooler locations during the hot summer months.

The diagram below represents human body cells and their interactions with the hormone, insulin.



43 Insulin resistance results when the body produces insulin but cells are not able to respond to it. This resistance could result in

(1) a lower level of glucose in the bloodstream
(2) an increase of glucose in the cell
(3) a failure of glucose to leave the cells
(4) an increase in glucose in the bloodstream

Part B–2

Answer all questions in this part. [12]

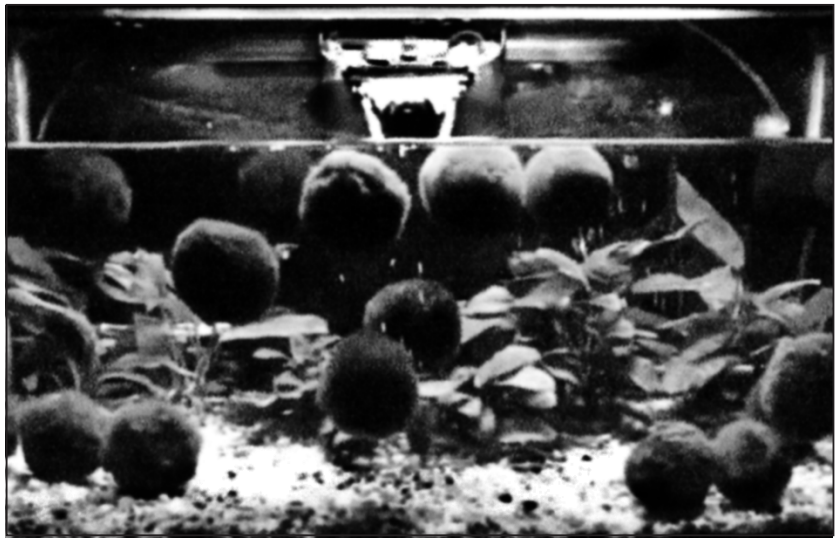
Directions (44–55): For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes each statement or answers each question. For all other questions in this part, follow the directions given and record your answers in the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

Base your answers to questions 44 through 49 on the information below, on the next page, and on your knowledge of biology.

Why Do Marimo Balls Float and Sink?

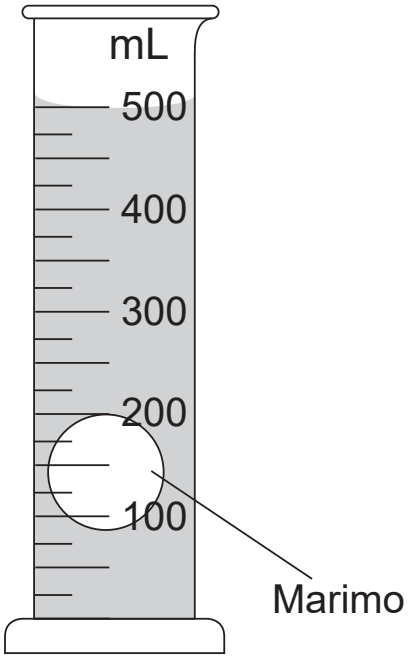
Marimo are fuzzy, round balls of a rare algae that is native to some cold, freshwater lakes. They have been observed to float after dawn and sink after dusk. A group of scientists conducted experiments to determine the cause of this floating and sinking action.

In one experiment, a marimo ball was placed in a graduated cylinder with 500 mL of water and exposed to light for four minutes. After four minutes, the light was turned off and the marimo was kept in the dark for another four minutes. The position of the marimo was measured each minute by recording the location of the marimo in the graduated cylinder with respect to the mL lines.



The experimental setup and data table are shown below. The data table gives the position of the top of the marimo in the cylinder during the eight-minute interval.

Experimental Set-up



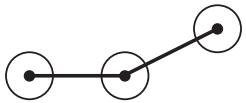
Marimo Position in Light and Dark Conditions

	Time (minutes)	**Position** (mL)
Light on	1	100
	2	225
	3	500
	4	500
Light off	5	500
	6	425
	7	200
	8	100

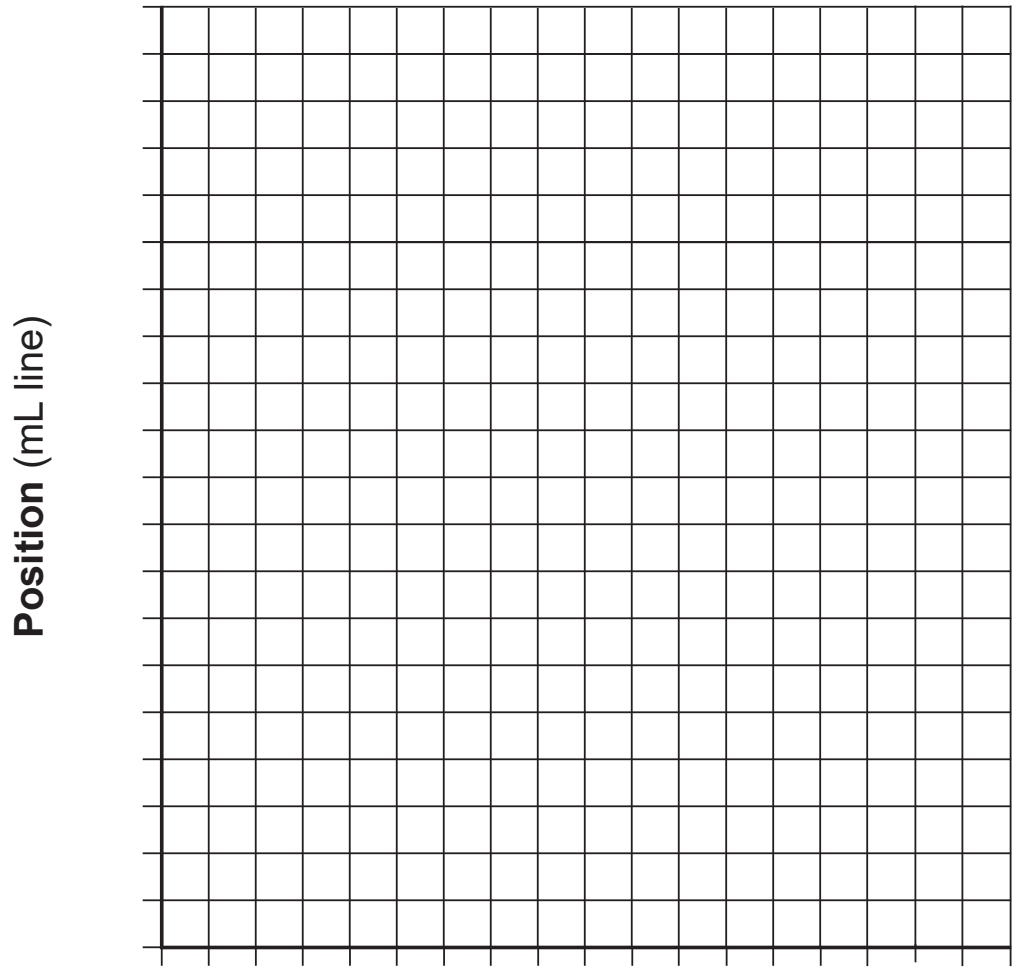
Directions (44–45): Using the information given in the data table, construct a line graph on the grid provided, following the instructions below.

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

45 Plot the data on the grid provided. Connect the points and surround each point with a small circle. [1]

Example: 

Marimo Position in Light and Dark Conditions



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46 State the relationship between the light exposure and the position of the marimo balls. [1]

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

47 The scientists observed that when the marimo were floating, they were covered with tiny bubbles. They hypothesized that these bubbles were products of photosynthesis. Therefore, the bubbles were most likely

(1) carbon dioxide
(2) hydrogen
(3) glucose
(4) oxygen

48 Describe *one* advantage to the marimo algal balls having the ability to float during the day. [1]

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

49 In order to determine if the floating of marimo was due to photosynthesis, the scientists treated them with DCMU, a chemical that prevents cells from carrying out photosynthesis. The DCMU-treated marimo were exposed to light continuously for 48 hours. No bubbles were observed on the surface of the treated marimo and they did not float.

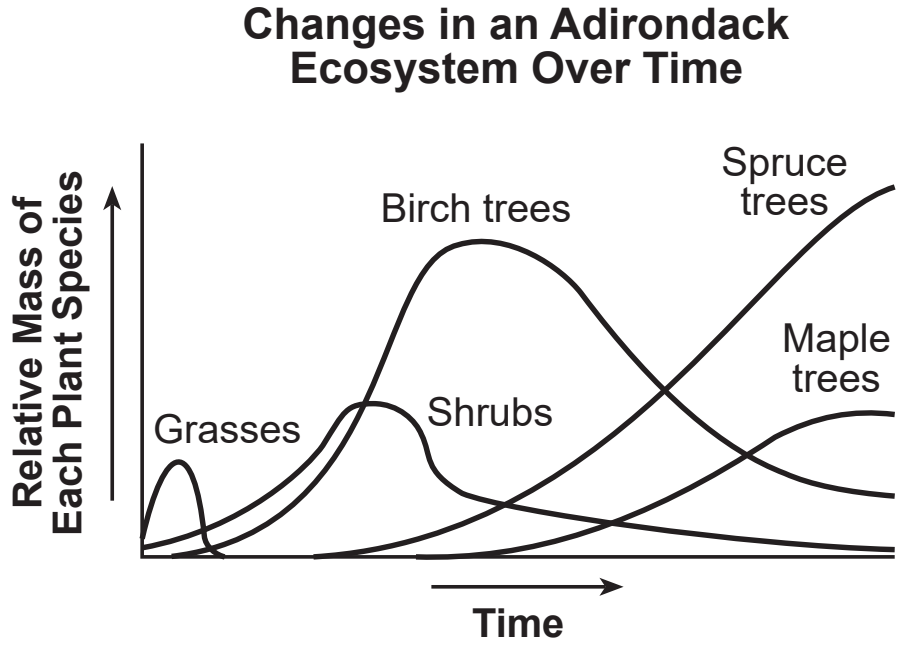
Based on these results, scientists can conclude that

(1) gas released during photosynthesis causes marimo to float
(2) warmer temperatures cause marimo to float
(3) photosynthesis is not responsible for marimo floating
(4) DCMU treatment increases the ability to float

Base your answers to questions 50 and 51 on the information and graph below and on your knowledge of biology.

Adirondack Logging Results

A forested area in the Adirondacks was heavily logged in the early 1900s. The logging ended in 1915, leaving empty fields of grasses and some shrubs. Over the next 80 years, until 1995, the abundance of different plant species was recorded periodically to show the changes that occurred in the area. A graph representing these changes is shown below.



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

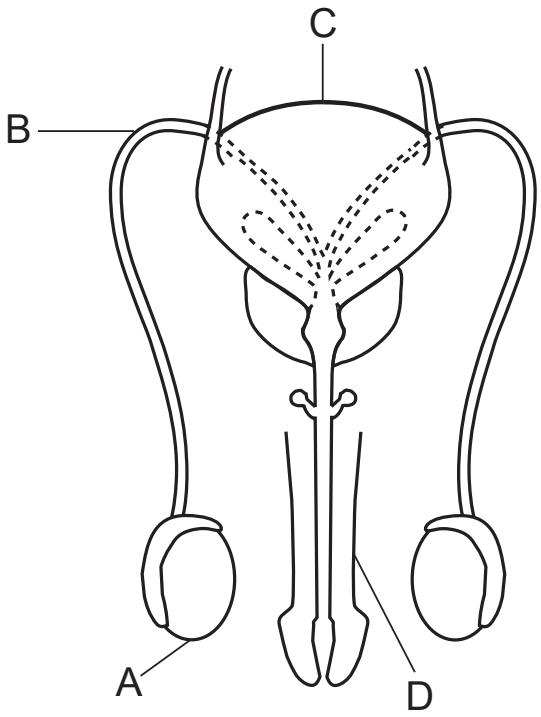
50 Which inference is reasonable, based on the data in the graph?

(1) Spruce grouse, which inhabit spruce forests, became more common over the years.
(2) Mice and other grassland species remained abundant in the area for many years.
(3) Birds living in this area in 1995 preferred shrub habitats over heavily wooded habitats.
(4) Birch trees are likely the most common type of tree species in the area today.

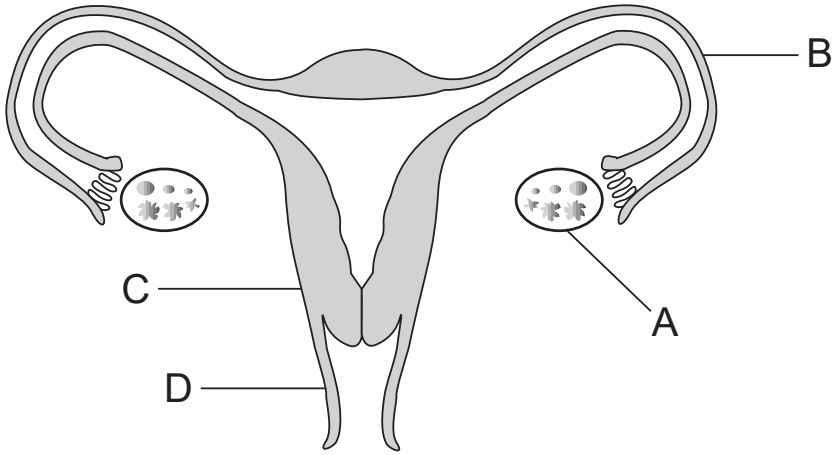
51 Describe how the graph would likely appear 20 or more years after 1995 if the study had continued. Support your answer. [1]

The diagrams below represent parts of the human male and female reproductive systems.

Male Reproductive System

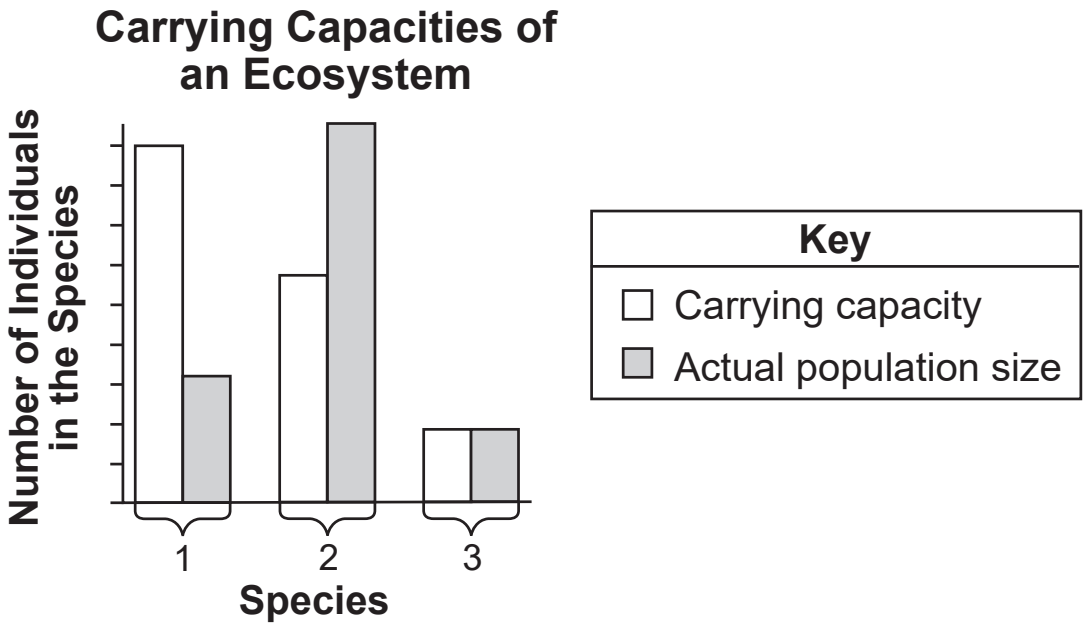


Female Reproductive System



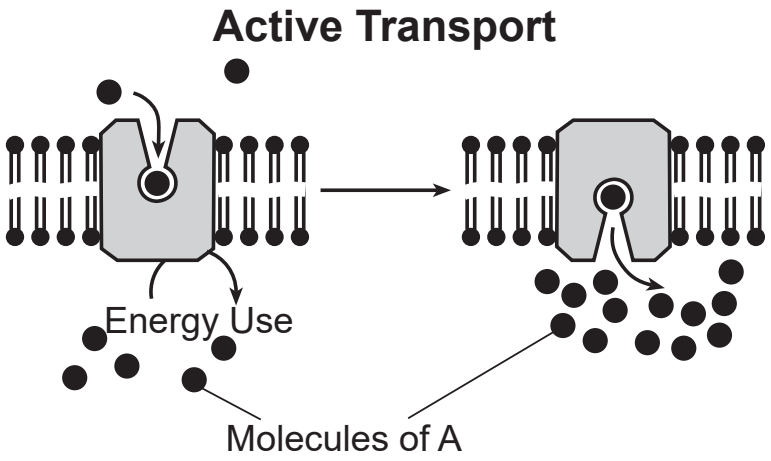
52 Identify *one* process carried out by *both* structures labeled *A*. [1]

The diagram below represents the carrying capacities of an ecosystem for three different species and the relative population sizes for each species in the area.



53 Which species is most likely to undergo a population increase in the future? Support your answer. [1]

Base your answers to questions 54 and 55 on the diagram below and on your knowledge of biology. The diagram illustrates the active transport of molecules of *A* through a portion of a cell membrane.



54 Explain why this diagram is labeled "Active Transport." [1]

55 The "Energy Use" label involves a specific molecule produced by this cell. Identify this molecule and a cellular process that produces it. [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, on the next page, and on your knowledge of biology.

Why Honey Badgers Don't Care

The honey badger, found in parts of India, Africa, and the Middle East, has been identified as "the world's most fearless creature" by the *Guinness Book of World Records*. Although they are primarily carnivorous, honey badgers consume a wide variety of food: rodents, insects, bee larvae, birds, and fruit. Venomous snakes, including cobras and puff adders, are also favorite items on their menu.

As much as 25% of a honey badger's diet consists of venomous snakes with fangs. The adaptation to withstand snake venom has enabled them to be one of the only predators to feast on this source of meat. They hunt fairly slow-moving prey with fangs rather than fast prey with claws and teeth.

Snake venom contains more than 100 proteins that could potentially poison a honey badger—meaning that honey badgers need multiple defenses. Scientists have focused their research on a nasty class of molecules in cobra venom called alpha-neurotoxins, that paralyze the muscles associated with breathing. These neurotoxins block a specific receptor and therefore prevent muscle cells from receiving signals from the nervous system.

Presently, most antivenoms used to treat snake bites are made of proteins produced by the immune systems of horses and sheep exposed to specific snake venoms. These proteins attack the venom directly in people bitten by a venomous snake.

56 Explain how the ability of honey badgers to eat venomous snakes is an example of a favorable adaptation. [1]

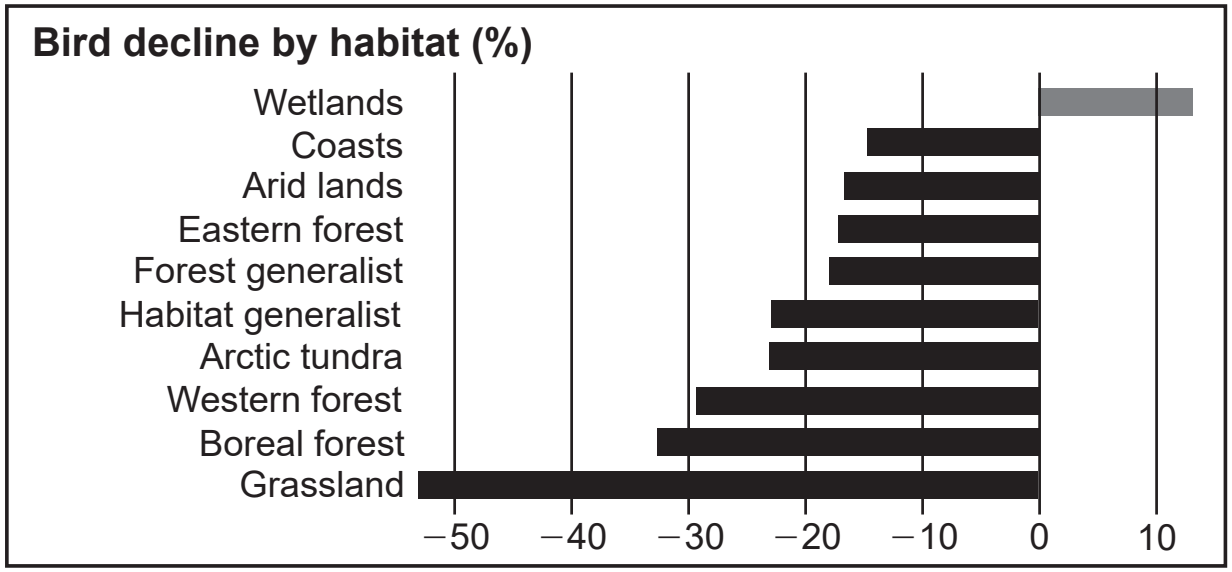
57 State why using an antivenom made from horse proteins could result in an allergic reaction. [1]

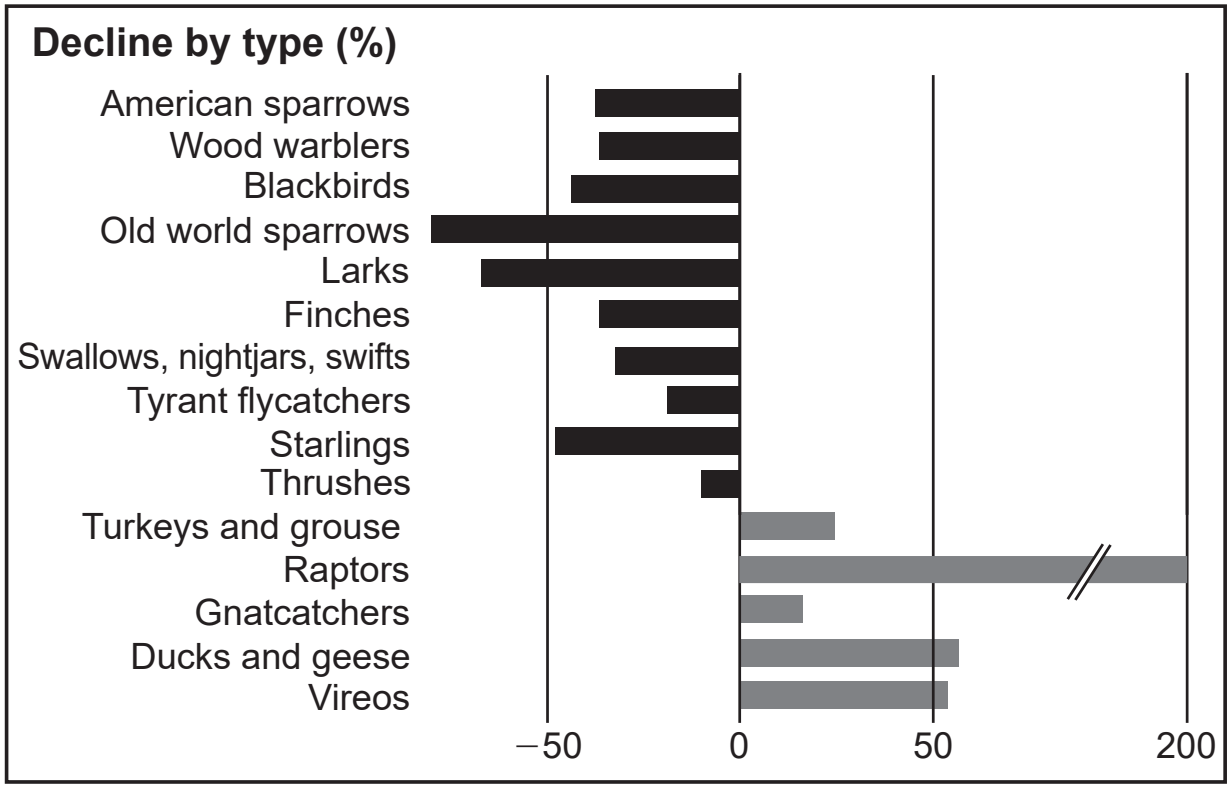
Base your answers to questions 58 through 60 on the information below, on the next page, and on your knowledge of biology.

Three Billion North American Birds Have Vanished Since 1970

Recent surveys of 529 bird species revealed that since 1970 the North American continent lost 3 billion birds, 29% of the total. Birds are excellent indicators of environmental health and are vital to ecosystems. Common bird species control insects, pollinate flowers, spread seeds, and help regenerate forests. As a result, when these birds disappear, their former habitats are not the same.

Change in North American Bird Populations Since 1970





Many factors influence the bird populations. Loss of habitat to urban sprawl, converting grasslands into farmlands, and the use of pesticides to reduce insect populations have been particularly hard on some bird species. Changes to natural habitats can reduce nesting sites and limit flight paths for migratory birds. House cats that are allowed outside and feral cats contribute significantly to the loss of birds.

However, some birds have increased due to changes in human activities. Studies found that raptors (predators) such as bald eagles have rebounded after the pesticide DDT was banned. Waterfowl such as ducks and geese have also increased due to conservation programs.

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58 Explain why the decline in some North American bird populations is having a *negative* effect on ecosystems. [1]

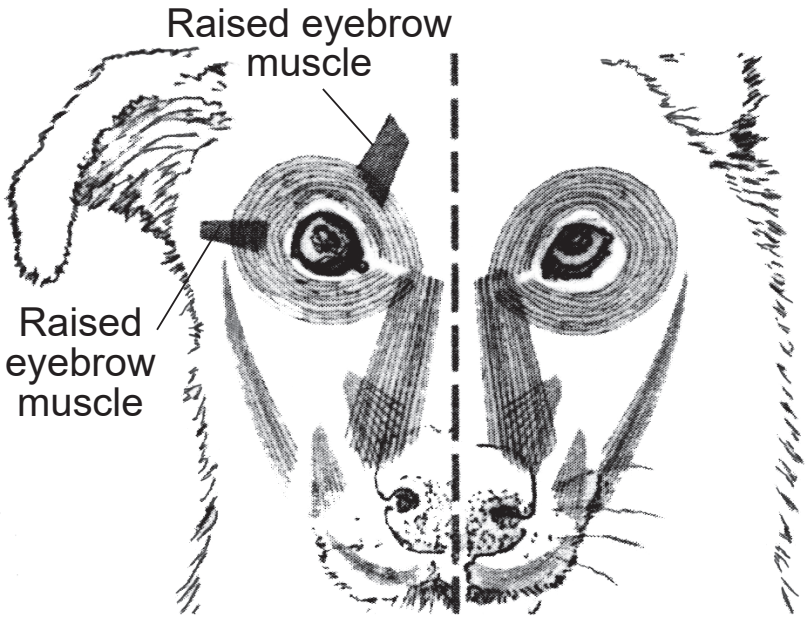
59 Identify the habitat that has had the greatest *decline* in birds since 1970, and describe a cause of the loss of birds in that habitat. [1]

The bobolink is a small blackbird whose population has undergone a decline of 75% in some regions. These birds nest in fields of tall grass during the summer across the northern United States and migrate long distances to winter in southern South America.

60 Describe an action people might take that could reduce the decline in the bobolink population. [1]

Base your answers to questions 61 and 62 on the information below, on the next page, and on your knowledge of biology.

New research comparing the anatomy and behavior of dogs and wolves found that dogs have small facial muscles around their eyes which allow them to raise their inner eyebrow. This makes their eyes appear larger and more infant-like. Wolves do not have these muscles.

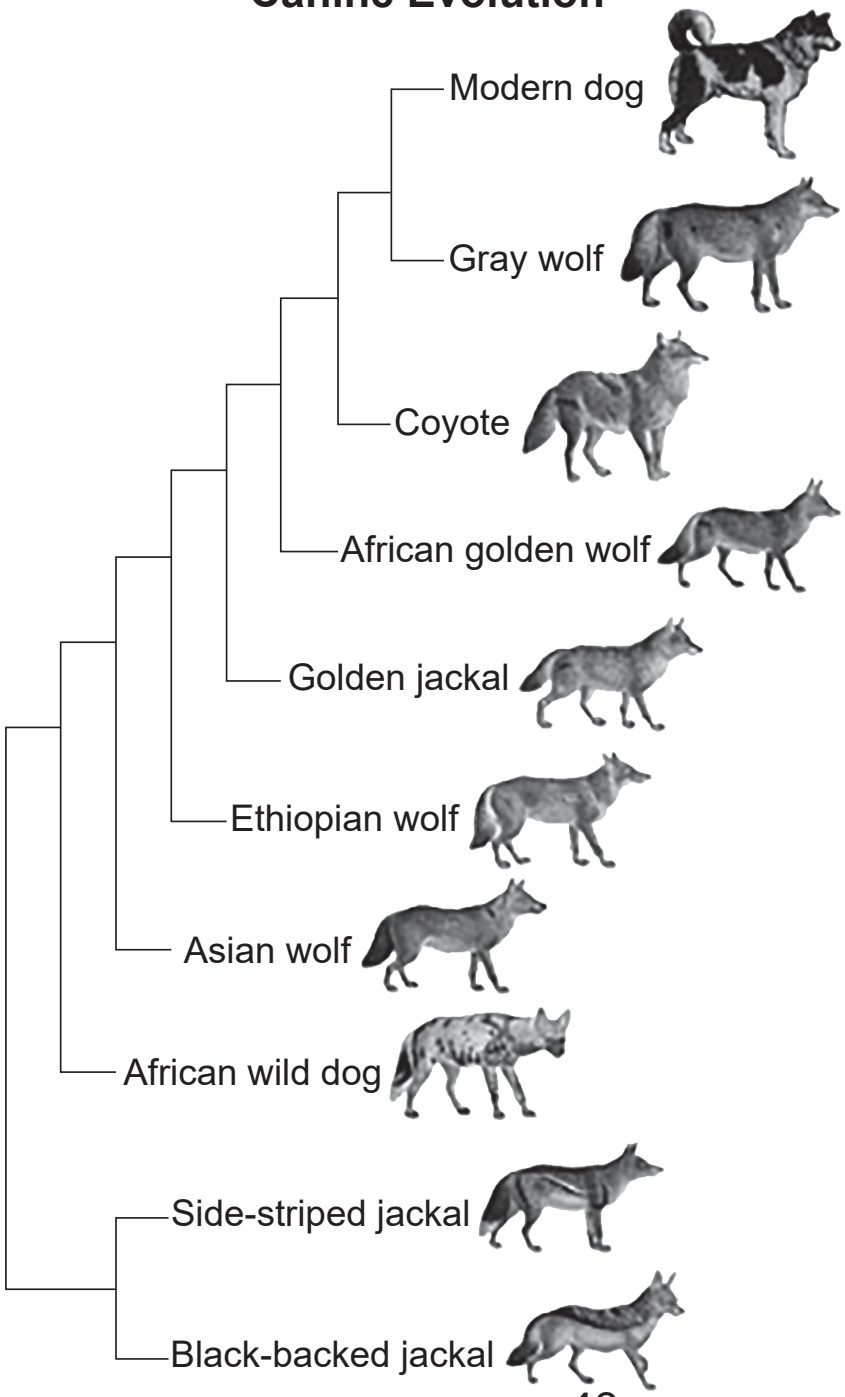


Facial musculature in the dog (left) and wolf (right) with anatomical differences.

Scientists hypothesize that dogs expressing this "puppy-dog eye" trait unconsciously stimulate a desire in humans to take care of them.

Examine the evolutionary tree below of modern dogs and their relatives.

Canine Evolution



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61 According to the evolutionary tree, identify which species, the African golden wolf or the modern dog, is most closely related to the gray wolf. Support your answer with evidence from the evolutionary tree. [1]

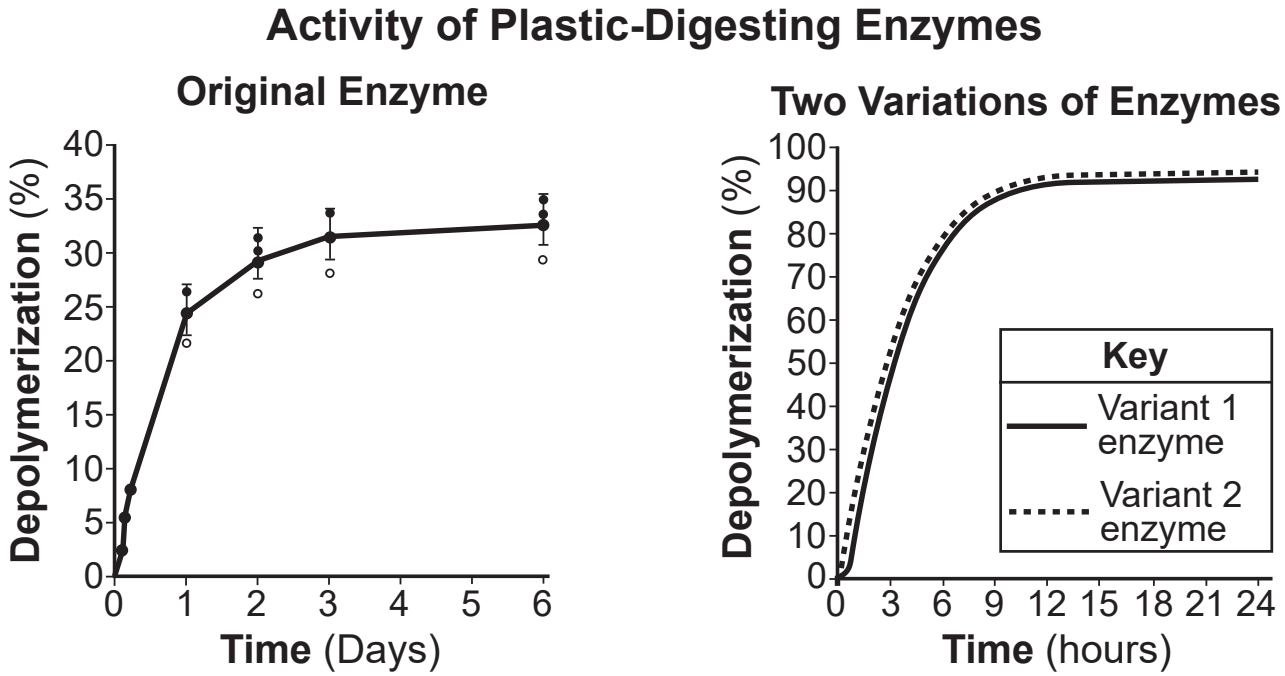
62 Explain how genes for a trait such as puppy-dog eyes in domesticated dogs could have increased in frequency over time. [1]

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

Breaking Down Plastics

Researchers collected soil contaminated with specific plastics outside a plastic bottle recycling facility. They discovered a type of bacterium in the soil that was able to depolymerize (break down) and use these plastics as a source of nutrition. A bacterial enzyme that could digest large molecules of plastic into their building blocks was isolated. Those building blocks can be used to produce new plastic products. Scientists have been working to improve the efficiency of this enzyme by altering the specific molecules the bacteria need to code for the synthesis of the enzyme. Using this method, many variations of the enzyme were produced by the altered bacteria, and these variants were tested.

The graphs below show a comparison of the activity of the original enzyme and two variants produced by the scientists.



63 Using evidence from the graphs, support the claim that the scientists were successful in developing a more efficient enzyme. [1]

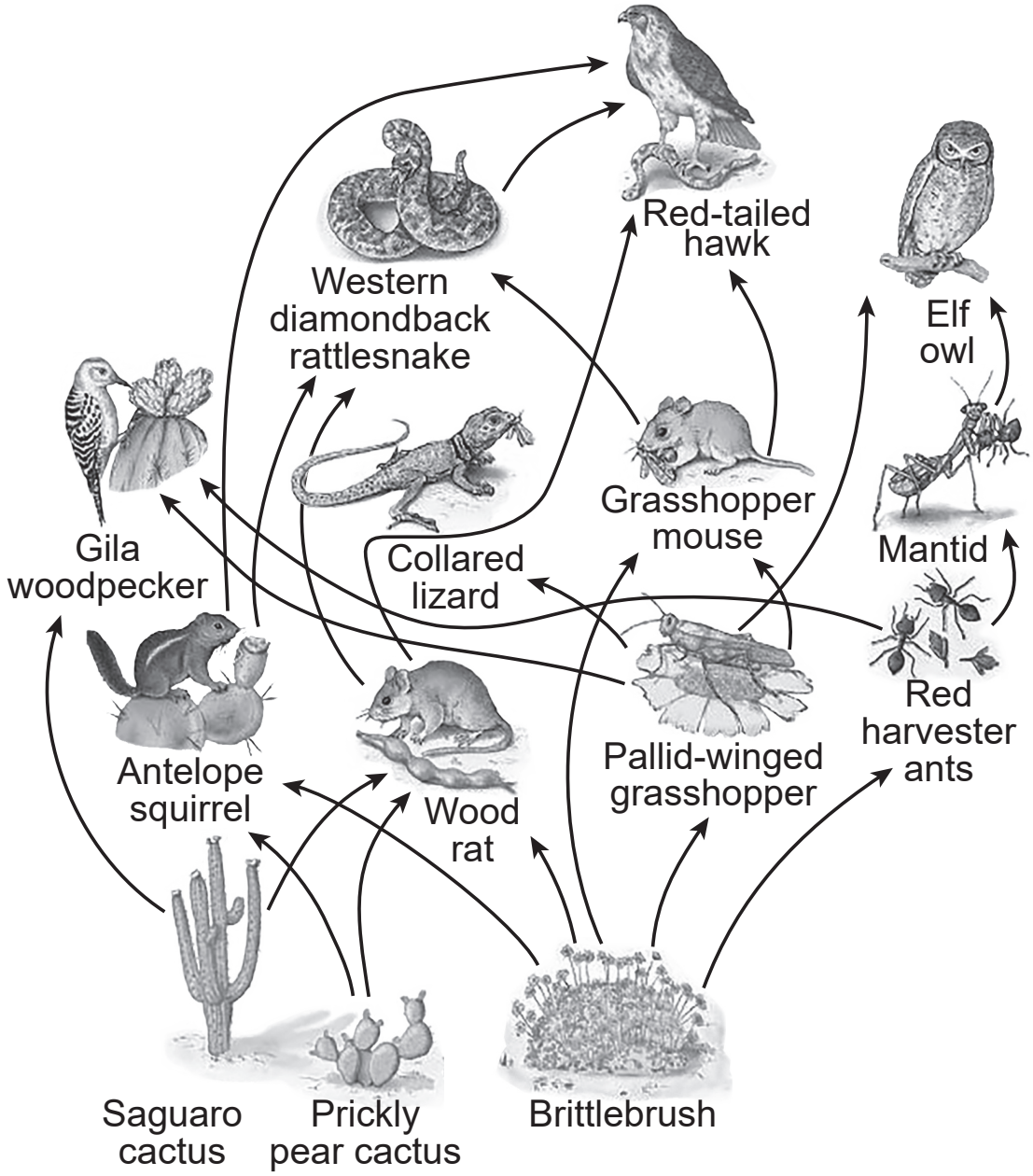
64 Describe a technique the scientists most likely would use to alter the specific molecules in the bacteria referred to in the reading. [1]

65 Explain how using these modified enzymes can benefit the environment. [1]

66 Explain why these enzymes will break down specific plastics but *not* react with other substances. [1]

Base your answers to questions 67 through 69 on the partial Arizona desert food web represented below and on your knowledge of biology.

Arizona Desert Food Web



Desert food webs are complex and often contain more food chains than a grassland or forest food web. This is important to the stability of the desert ecosystem.

Relationships between organisms can be described as positive, negative, or neutral.

Positive relationship:	Both species benefit.
Negative relationship:	Either species would benefit if the other species were no longer present.
Neutral relationship:	The species have no effect on each other.

67 Identify the type of relationship between the collared lizard and the grasshopper mouse as positive, negative, or neutral. Support your answer with information from the food web. [1]

68 People often want to remove top-level predators from an ecosystem. There are a number of reasons for this, depending on the area and the predator. Explain how removing the red-tailed hawk would affect the prickly pear cactus population in this food web. Support your answer with information from the food web. [1]

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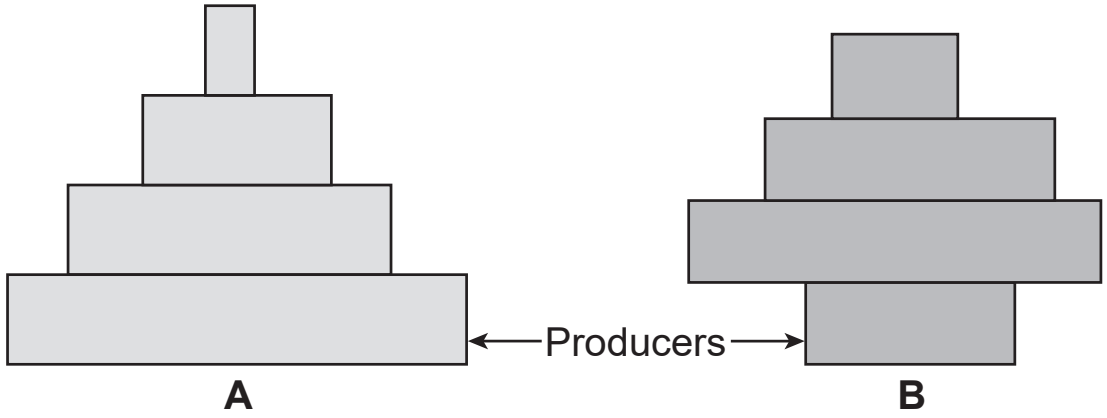
One group of students drew energy pyramid *A* to model where the energy is located in the Arizona desert food web. Another group of students drew energy pyramid *B* for their model.

Model Arizona Desert Energy Pyramids



69 If energy pyramid *B* actually represents what is happening in that area of the desert, explain what would eventually happen and why. [1]

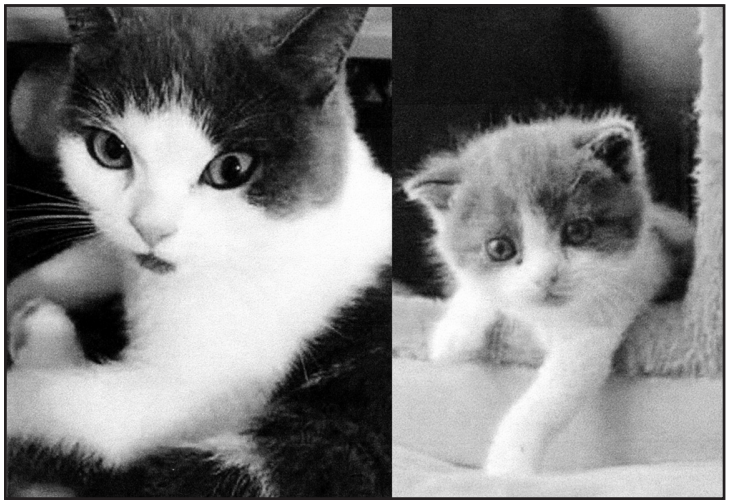
In 1980 the red wolf was declared extinct in the wild. Only one small captive population survives in North Carolina. Recently a group of canines resembling coyotes but with red fur were discovered on an island near Texas. They are clearly a kind of coyote, but could possibly contain some red wolf genetic material.

70 Scientists suggest that breeding the red-coated coyotes that might contain genetic material could help increase diversity within the existing red wolf population in North Carolina.

Explain why increasing the diversity in the red wolf population could be beneficial to the species. [1]

Base your answers to questions 71 and 72 on the information below and on your knowledge of biology.

A cat owner was devastated by the death of his beloved cat, Garlic. He contacted a cloning company that was able to produce Garlic 2.0 using DNA from preserved cells of the original cat. However, the client was disappointed to see that while Garlic 2.0 was very similar to his original pet, there were slight differences in the cloned cat's appearance.



Original Garlic Garlic 2.0

71 Other than age or an error in the cloning process, describe *one* factor that could have led to the differences observed in Garlic 2.0, as compared to the original cat. [1]

The embryo that became Garlic 2.0 was implanted into another cat, a surrogate mother shown in the photo below.

Garlic 2.0 (right) and surrogate mother

72 Explain why scientists claimed that the surrogate mother did *not* determine the genetic makeup of the Garlic 2.0 embryo. [1]

Part D

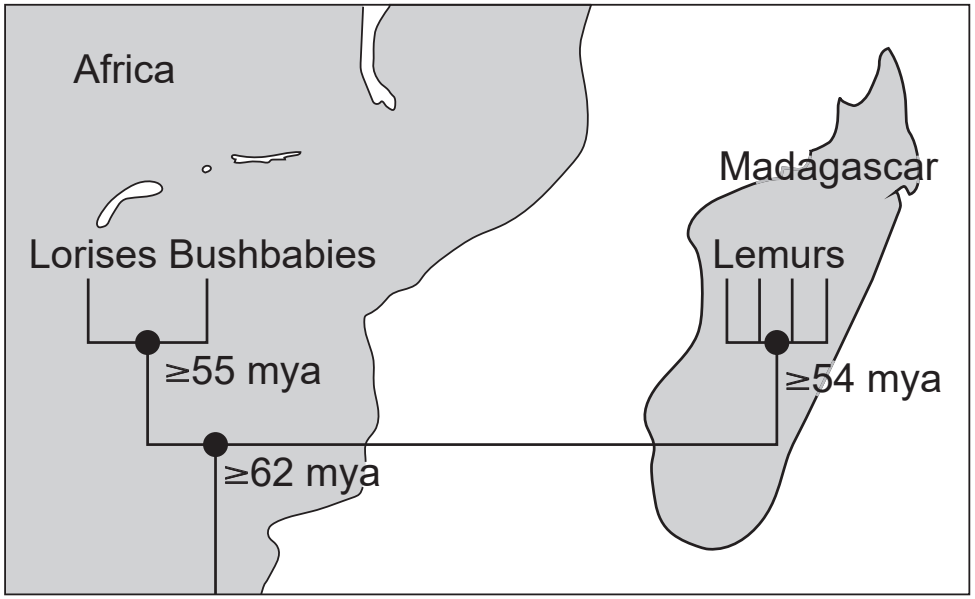
Answer all questions in this part. [13]

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 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 73 and 74 on the information below and on your knowledge of biology.

Lemurs of Madagascar

Lemurs are primates found only on the island of Madagascar, which is located about 250 miles off the coast of Africa. The ancestral species of lemurs arrived 40-50 million years ago (mya), long after Madagascar became an island. This concept is illustrated in the diagram below.



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

73 Since the arrival of the single ancestral species on Madagascar, there are now over 100 species of lemurs. Which statement is a likely explanation for the current diversity of lemurs?

(1) Genetic variation was limited because they were living on an island.
(2) There were no natural predators and many available niches.
(3) Competition between lemurs stopped natural selection.
(4) Habitats were destroyed after the arrival of humans.

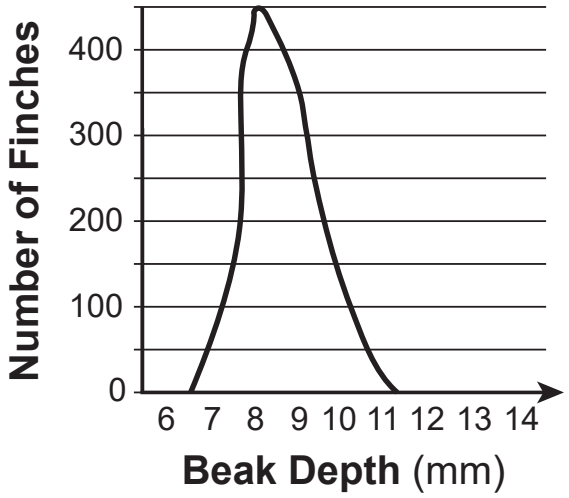
Note: The answer to question 74 should be recorded on your separate answer sheet.

74 Which is an example of physical evidence that could be used to support a possible evolutionary relationship among lemur species?

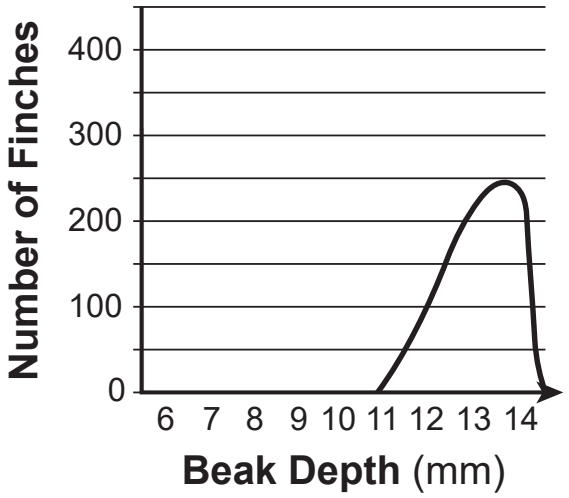
(1) similar amino acids
(2) similar social behaviors
(3) similar food choices
(4) similar skeletal structures

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

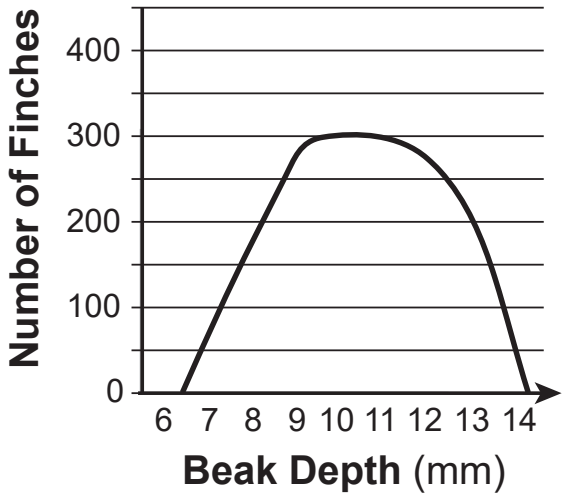
75 Drastic environmental changes are occurring on an island. Which graph below best represents the variation in finch beak sizes that would most likely provide the greatest chance for survival?



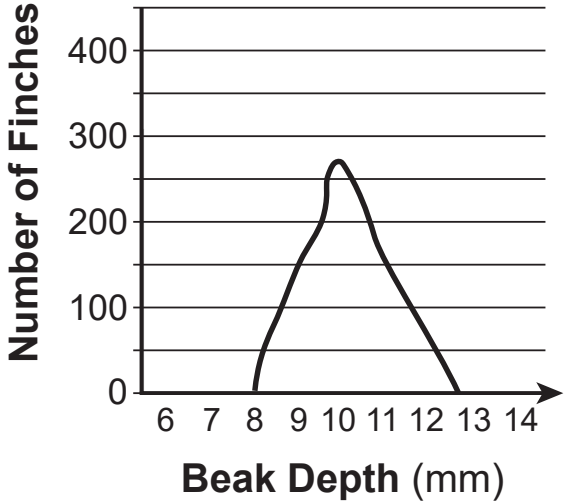
(1)



(3)



(2)



(4)

The chart below compares some of the characteristics of four different plant species.

Comparison of Four Plant Species

Plant Species	Flower Color	Enzyme X Present	Leaf Shape/Color	Number of Flower Petals
A	blue	yes	oval/dark green	7
B	blue	no	oval/yellow green	5
C	red	yes	oval/dark green	7
D	red	no	oval/dark green	5

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

76 According to the information provided in the chart, which two plant species appear to be the most closely related?

(1) *A* and *B*
(2) *B* and *D*
(3) *C* and *A*
(4) *D* and *C*

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

A gene segment from a species of plant has the following sequence:

ATTCCGGATCGATCGCCGGATATACTCCGGTAATATC

77 This segment was cut with a restriction enzyme that recognizes CCGG and cuts between the *C* and *G*. The fragments were then analyzed using gel electrophoresis.

How many bands would you expect to appear on the gel? [1]

_____

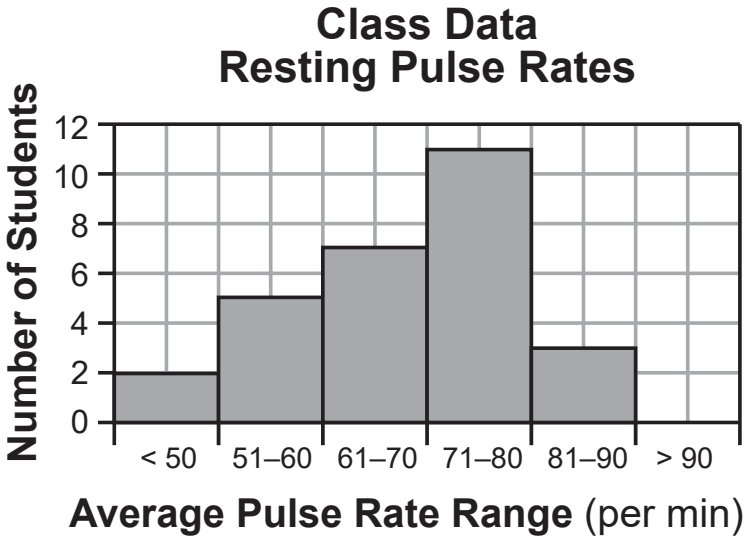
78 Once the gel is running, explain why the segments would move different distances in the gel. [1]

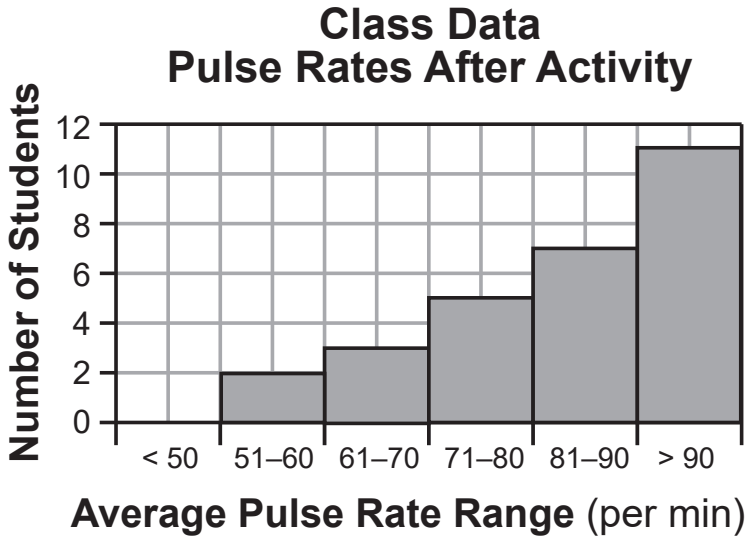
_____

_____

_____

Students in a class performed an experiment. They recorded their resting pulse rates. Then, they ran in place and immediately recorded their pulse rates again. The data obtained are shown in the two histograms below.





79 State *one* hypothesis about the effects of exercise on pulse rate. [1]

A student in a biology class squeezed a clothespin as many times as possible in a 60-second period. After resting for 20 seconds, they then repeated the experiment, for a total of five trial periods of "squeezing/resting." The student recorded their experimental data in the table below.

Clothespin Data

Trial	Number of Clothespin Squeezes in 60 Seconds
1	82
2	75
3	58
4	50
5	45

The student reported feeling some burning in their finger muscles after squeezing the clothespin. The teacher explained that the burning sensation may have been due to a buildup of waste products in the finger muscles.

80 Predict the number of clothespin squeezes expected if the student had performed a sixth trial. Support your answer. [1]

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

81 A recent newspaper headline read, "Expert Warns About Effect of Rock Salt on Plants". The de-icing chemical, rock salt, has been used on highways for years. The concern expressed by the expert is most likely that

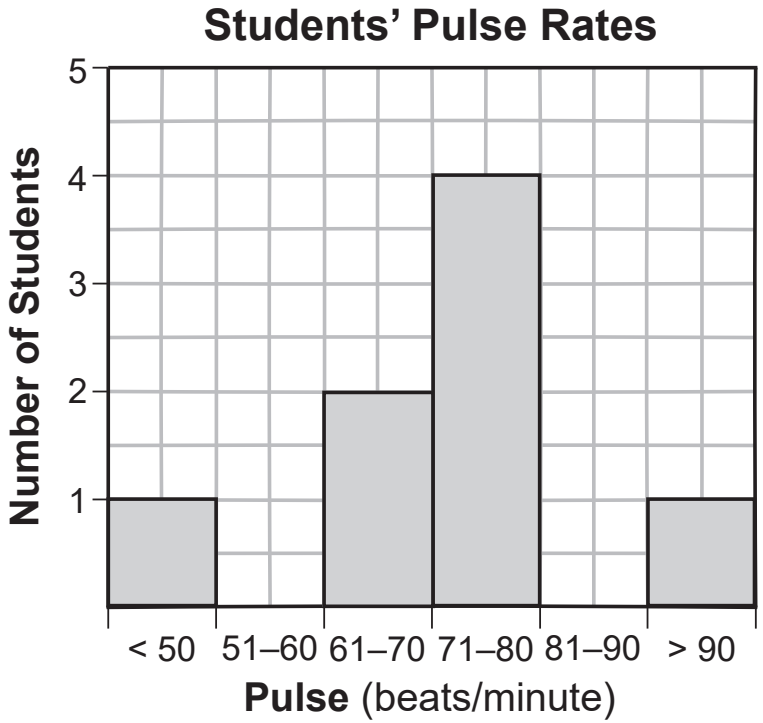
(1) the salt will enter the plants and make them too salty and unusable as food
(2) the presence of salt in the environment will cause the plants to lose water
(3) de-icing chemicals always present a safety risk to humans
(4) plants respond more rapidly to salt in colder temperatures

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

82 Some runners prepare for a race by completing a variety of warmups. These exercises are beneficial because they

(1) can prevent the production of carbon dioxide in muscle cells
(2) speed up the breakdown of protein that is released during respiration
(3) reduce the need for water in muscle cell metabolism
(4) can increase the flow of blood within the body

A group of students took their pulse rates. The results are shown in the graph below.



A student wrote the hypothesis, "Students who smoke tend to have a higher pulse rate than students who do not smoke."

83 What additional information is needed to test the student's hypothesis? [1]

Base your answers to questions 84 and 85 on the diagram below and on your knowledge of biology. The diagram illustrates different finch species living in a certain area.

 Warbler finch: probing bill, insect eater, feeds in trees	 Woodpecker finch: probing bill,insect eater, uses twig or cactus spine to remove insects from cactus	 Mangrove finch: grasping bill, insect eater, feeds in trees	 Vegetarian finch: crushing bill, cactus-seed eater

84 If the common ancestor of the four finches originally lived on an island with few trees, little rain, and very few insects, identify which finch it might most likely resemble and support your answer. [1]

85 Identify the finch in the diagram most likely to compete with the mangrove finch. Support your answer. [1]

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