

LIVING ENVIRONMENT

Thursday, August 17, 2017 — 12:30 to 3:30 p.m., only

Student Name _____

School Name _____

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

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

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

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

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

Notice ...

A four-function or scientific calculator must be 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 A fruit fly is classified as a consumer rather than as a producer because it is unable to
- (1) reproduce asexually
 - (2) synthesize its own food
 - (3) release energy stored in organic molecules
 - (4) remove wastes from its body

- 2 Which change is an example of maintaining dynamic equilibrium?

- (1) A plant wilts when more water is lost from the leaves than is lost by the roots.
- (2) A plant turns yellow when light levels are very low.
- (3) Insulin is released when glucose levels in the blood are high.
- (4) A person sweats when the environmental temperature is low.

- 3 Organisms contain compounds such as proteins, starches, and fats. The chemical bonds in these compounds can be a source of

- | | |
|-------------------|-------------|
| (1) amino acids | (3) energy |
| (2) simple sugars | (4) enzymes |

- 4 Phosphorus is necessary for the growth of healthy plants. Scientists are developing plants that can grow in phosphorus-poor soil. Some of these new varieties, produced in a lab, make extra copies of a protein that helps them obtain more phosphorus from the soil. The process being used to develop these new varieties is most likely

- (1) paper chromatography
- (2) natural selection
- (3) direct harvesting
- (4) genetic engineering

- 5 Which life function is *not* necessary for an individual organism to stay alive?

- | | |
|------------------|----------------|
| (1) nutrition | (3) regulation |
| (2) reproduction | (4) excretion |

- 6 Lobsters prey on sea hares, which are marine animals. The lobsters find their prey through a sense of smell. The sea hares defend themselves by squirting ink at the lobster, as shown in the photo below. The ink sticks to the lobster, interfering with its sense of smell.



The most likely reason the sea hare can escape is because the sea hare ink

- (1) pushes the sea hare away rapidly as the ink is expelled
 - (2) blocks a receptor on certain cells in the lobster
 - (3) causes the lobster to change its prey
 - (4) prevents movement of the lobster
- 7 Which statement is an accurate description of genes?
- (1) Proteins are made of genes and code for DNA.
 - (2) Genes are made of proteins that code for nitrogen bases.
 - (3) DNA is made of carbohydrates that code for genes.
 - (4) Genes are made of DNA and code for proteins.

8 The bobolink is a small blackbird that nests in fields of tall grass. It breeds in the summer across much of southern Canada and the northern United States. It migrates long distances, wintering in southern South America. The numbers of these birds are declining due to disruption of the areas where they live.



In order to save these birds from extinction, the best course of action would be to

- (1) prevent the birds from migrating to South America
- (2) encourage farmers to let their hay fields undergo succession
- (3) work to protect bobolink habitats in South and North America
- (4) capture all the bobolinks and keep them safe in zoos

9 A child with cystic fibrosis has an altered protein in his cells that stops chloride ions from leaving the cells. This protein most likely affects the functioning of

- (1) cell membranes
- (2) nuclei
- (3) mitochondria
- (4) ribosomes

10 Which row in the chart below shows a direct relationship that can exist between two living organisms?

Row	Relationship
(1)	producer – carnivore
(2)	predator – prey
(3)	parasite – prey
(4)	carnivore – host

11 Scientists have studied the return of plant life on Mount St. Helens ever since the volcano erupted in 1980. Wildflowers began colonizing the area, followed by shrubs and small trees. Scientists predict that it will likely take hundreds of years before the area returns to a forest dominated by fir and hemlock trees. These changes are an example of

- (1) humans degrading an ecosystem by removing wildflowers
- (2) the loss of genetic variation in a plant species
- (3) the growth of a forest through ecological succession
- (4) the biological evolution of wildflowers, shrubs, and trees

12 The most likely result of completely removing carbon dioxide from the environment of a plant is that sugar production will

- (1) continue at the same rate
- (2) increase and oxygen production will also increase
- (3) increase and oxygen production will stay the same
- (4) decrease and eventually stop

13 Before a new shopping center can be built on previously undeveloped land, the builders must submit a proposal to the local government for approval. Which statement identifies an environmental concern associated with the development of the shopping center?

- (1) Building the center would decrease resources needed by local organisms.
- (2) The new shopping center would increase competition with already existing businesses.
- (3) Building the center would decrease the amount of pollution in the area.
- (4) The new shopping center would increase the biodiversity of the area.

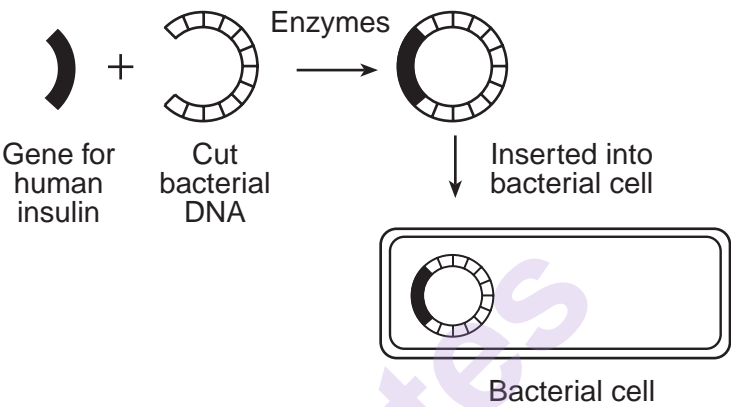
14 Homeowners have been encouraged to learn how to identify invasive plants and to remove them if they find them. The most likely reason for removing invasive plants is to

- (1) allow only one type of native plant to grow
- (2) preserve biodiversity
- (3) eliminate unfamiliar food sources
- (4) increase the rate of ecological succession

15 Which row in the chart below correctly pairs a human activity with its impact on the environment?

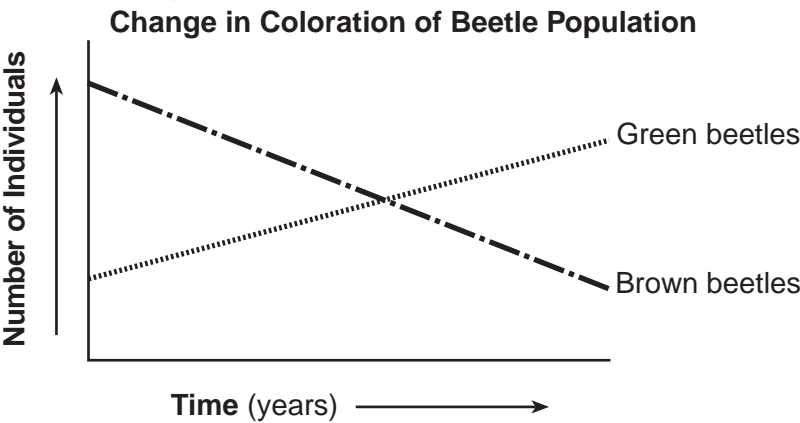
Row	Human Activity	Impact
(1)	decrease in the use of pesticides	erosion of rock in the soil
(2)	increase in housing developments	improvement in air quality
(3)	increase in human population	reduction in water usage
(4)	decrease in recycling	reduction in amount of available resources

16 The diagram below represents some steps in a procedure used in the field of biotechnology.



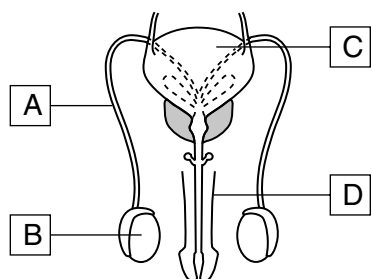
- This bacterial cell can now be used to produce
- (1) the bacterial gene for insulin that can be inserted into humans
 - (2) human genes for enzymes that can be inserted into humans
 - (3) insulin that can be used by humans
 - (4) enzymes necessary to treat human diseases

17 The graph below represents the number of brown and green beetles collected in a particular ecosystem.



- The change observed in the number of green and brown beetles in the population is most likely due to
- (1) natural selection
 - (2) selective breeding
 - (3) gene manipulation
 - (4) a common ancestor

18 A reproductive system is represented in the diagram below.



Which structure is correctly paired with its reproductive function?

- (1) A – pathway of gametes
- (2) B – synthesis of progesterone
- (3) C – production of sperm
- (4) D – regulation of homeostasis

19 For centuries, humans have used resources from coastal areas and open ocean waters. An example of an activity that would promote the conservation of coastal areas and ocean resources is

- (1) harvesting large numbers of different fish species
- (2) allowing all-terrain vehicles access to beach areas
- (3) creating protected zones of natural grasses and shrubs in beach areas
- (4) encouraging the construction of factories along the ocean shoreline

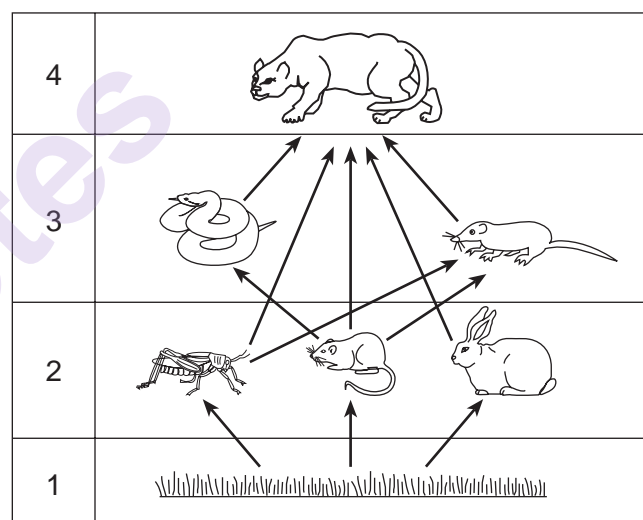
20 Which activity would eventually result in a stable ecosystem?

- (1) deforestation in an area to increase space for the species living there
- (2) mowing a large field so it can be used for recreation
- (3) allowing native plants to grow undisturbed in an abandoned field
- (4) spraying pesticides on a field at the end of each growing season

21 Some states require shoppers to pay a deposit on certain beverage containers made of plastic and glass. When shoppers return the containers, their deposits are returned to them. How is this system intended to help the environment?

- (1) It encourages people to buy products that do not have a deposit.
- (2) It reduces the amount of money shoppers actually spend.
- (3) It reduces the amount of plastics and glass put into landfills.
- (4) It forces manufacturers to reduce air pollution when they are making the containers.

22 The diagram below represents a food web.



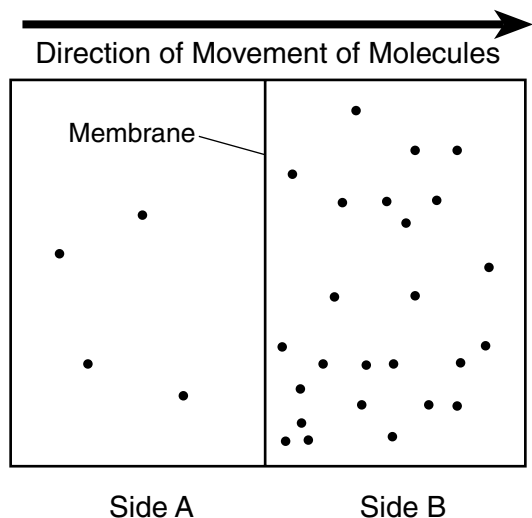
Which level contains organisms that carry out autotrophic nutrition?

- (1) 1
- (2) 2
- (3) 3
- (4) 4

23 Mad cow disease is a fatal disease that destroys brain tissue. Researchers have found that a prion protein, which is an abnormally constructed molecule, is responsible. Which statement best describes the characteristics a protein must have to function correctly?

- (1) A protein is a long chain of amino acids folded into a specific shape.
- (2) A protein is a long chain of simple sugars folded into a specific shape.
- (3) A protein is made of amino acids synthesized into a short, circular chain.
- (4) A protein is made of simple sugars synthesized into a short, circular chain.

- 24 The diagram below represents the results of the net movement of a specific kind of molecule across a living cell membrane.



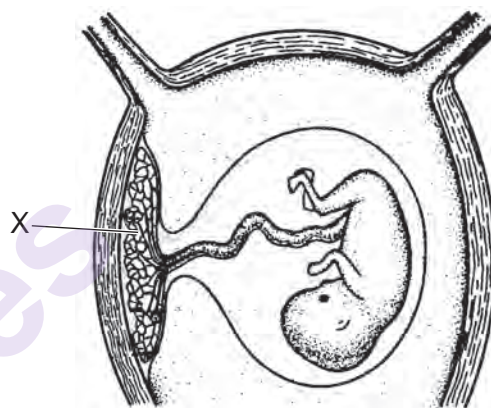
The movement of molecules from side A to side B is an example of the process of

- (1) active transport
 - (2) chromatography
 - (3) cellular respiration
 - (4) diffusion
- 25 Several companies now offer DNA “banking services,” where DNA is extracted from a pet and is stored so that a “replacement pet” might be produced using cloning techniques when the original pet dies. Which statement best explains why the replacement pets that are produced in this way might *not* look or act like the original?
- (1) The new animal must get the DNA from two different parents, not just one cell.
 - (2) Mutations could occur that change the cloned animal into a completely different species.
 - (3) Recombination of the cells as they are cloned will make the resulting pet act differently.
 - (4) The environment could influence how genes are expressed, changing how the animal looks and acts.

- 26 It is recommended that people avoid excessive use of tanning beds. Exposure to the radiation emitted by tanning beds can cause skin cancer. This cancer is the direct result of a

- (1) change in a starch molecule
- (2) mutation in the genetic material
- (3) mutation in a protein
- (4) change in a fat molecule

- 27 The diagram below represents a developing fetus in a human.



What would most likely happen if structure X were damaged in the early stages of pregnancy?

- (1) The genes from the mother would not be turned on in the fetus.
 - (2) The nutrients necessary for development would not be able to reach the fetus.
 - (3) The fertilized egg would not be able to travel from the ovary to the uterus.
 - (4) Development would take longer since the fetus would have to synthesize nutrients.
- 28 The reproductive structure in a female mammal that produces sex cells is the
- (1) ovary
 - (2) testes
 - (3) uterus
 - (4) placenta

- 29 Fungi are decomposers that play an important role in the maintenance of an ecosystem. The role of fungi is important because they
- (1) synthesize energy-rich compounds that are directly used by producers
 - (2) break down materials that can then be used by other organisms
 - (3) limit the number of plants that can perform photosynthesis in an area
 - (4) are competitors of other consumers such as herbivores
- 30 In 2011 and 2012, scientists working on the Banana River in Florida recorded a dramatic increase in the number of manatee deaths. Over the past 50 years, this area has also seen the human population increase by more than 500,000 people. It is believed that pollution from numerous sewage tanks leaked into the water, eliminating the manatees' food source, replacing it with an alga that is toxic to the manatee. This is an example of
- (1) a natural cycle in an ecosystem
 - (2) the effect of increased biodiversity on an ecosystem
 - (3) direct harvesting in an ecosystem
 - (4) human actions altering ecosystems with serious consequences
-

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Part B-1

Answer all questions in this part. [13]

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

- 31 A student performed an experiment to see if water temperature affects the level of activity in aquatic snails. The student set up four tanks with five snails in each tank. All four of the setups were identical in every way, except for the temperature of the water. In order to make the conclusions more valid, the student could

- (1) alter the pH of the water
- (2) change the size of the tank
- (3) carry out the experiment for a shorter period of time
- (4) use a larger number of snails

- 32 The following events occur during sexual reproduction:

- A. mitosis
- B. meiosis
- C. fertilization
- D. birth

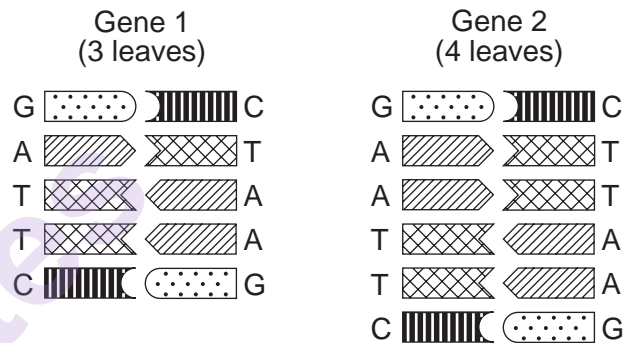
Which sequence represents the correct order of these events during sexual reproduction?

- (1) $A \rightarrow C \rightarrow B \rightarrow D$
- (2) $B \rightarrow C \rightarrow A \rightarrow D$
- (3) $C \rightarrow B \rightarrow A \rightarrow D$
- (4) $B \rightarrow A \rightarrow C \rightarrow D$

- 33 A broad body of evidence, subject to revisions, supported by different kinds of scientific investigations and often involving the contributions of scientists from different disciplines is necessary to develop

- (1) an inference
- (2) a fact
- (3) a theory
- (4) a prediction

- 34 The diagrams below represent portions of two genes that code for leaf structure in the same species of clover. Gene 1 was taken from the cells of a clover plant with 3 leaves and gene 2 was taken from the cells of a clover plant with 4 leaves.



The clover plant having gene 2 (4 leaves) was most likely the result of

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

- 35 Increased concern over the number of heat-related illnesses among football players has led to a possible change in uniform design. Shoulder pads were designed that constantly blew cool, dry air underneath the shoulder pads. Tests showed that the use of the device during rest and recovery periods resulted in a reduction of body temperature and heart rate. This new device would help the athlete to

- (1) control the rate of muscle activity
- (2) increase muscle strength
- (3) maintain homeostasis
- (4) eliminate the release of heat from the body

Base your answers to questions 36 and 37 on the information and data table below and on your knowledge of biology.

A student wanted to investigate the effect of light on the rate of ripening of tomatoes. She set up four pots of the same size with identical amounts of soil, water, and type of tomato plants. Each plant was exposed to a different intensity of light as shown in the table below.

Plant	Light Intensity (lumens)	
1	0	
2	1000	
3	5000	
4	10,000	

36 To report the final results, which label would be most appropriate for the third column of the data table?

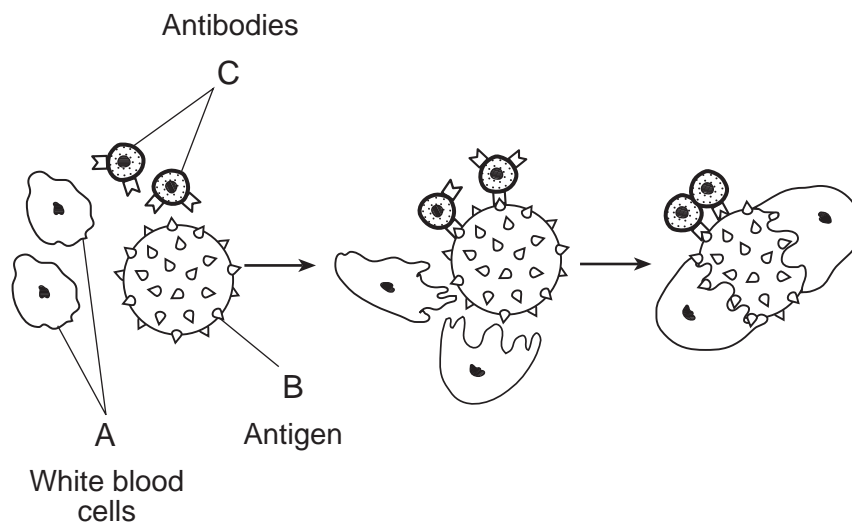
- (1) Height of Tomato Plants (cm)
- (2) Average Ripening Time (days)
- (3) Average Weight of Tomatoes per Plant (grams)
- (4) Acidity of Tomatoes (pH)

37 The independent variable in this experiment is the

- (1) type of tomato plant
 - (2) amount of soil provided
 - (3) color of tomatoes
 - (4) light intensity
-

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Base your answers to questions 38 and 39 on the diagram below and on your knowledge of biology. The diagram illustrates activities taking place in the body of a human.



38 Vaccinations usually stimulate the body to produce more of

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

39 Which structure normally stimulates an allergic response?

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

40 Which population in the chart below has the best chance for survival in a rapidly changing environment?

Population	Type of Reproduction	Average Life Span of Individuals	Total Number of Offspring Produced
(1)	sexual	13 days	100
(2)	asexual	13 days	100
(3)	sexual	12 weeks	25
(4)	asexual	12 weeks	25

- 41 The table below represents a segment of a DNA molecule found in a stomach cell, both before and after undergoing replication.

DNA Segment Before and After Replication

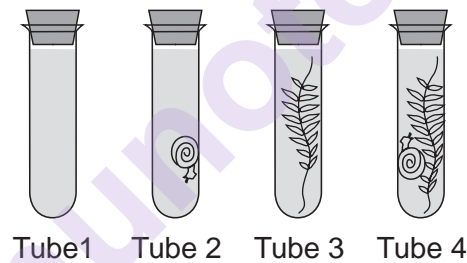
Before replication	TGT	ATG	AAA	CAC	AAT	TAT
After replication	TGT	ATT	AAA	CAC	AAT	TTT

Which statement best describes a change that would most likely be observed in the cells formed as a result of this mitotic division?

- (1) An enzyme the cell produces might no longer function.
- (2) The cells would begin to form gametes to be released.
- (3) Many new hormones would be synthesized by the cells.
- (4) Chloroplasts would be produced by the ribosomes.

Base your answers to questions 42 and 43 on the information and diagram below and on your knowledge of biology.

The setup below shows four test tubes. Tube 1 contains water only. Tube 2 contains a live snail. Tube 3 contains a live green water plant. Tube 4 contains both a live green water plant and a live snail.



- 42 In this setup, which tubes contain at least one organism carrying on cellular respiration?
- (1) tubes 1 and 2, only
 - (2) tubes 2 and 4, only
 - (3) tubes 3 and 4, only
 - (4) tubes 2, 3, and 4, only
- 43 Which compound that directly provides energy in living cells is being produced in every tube where cellular respiration is occurring?
- (1) oxygen
 - (2) glucose
 - (3) DNA
 - (4) ATP
-

Part B–2

Answer all questions in this part. [12]

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

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

The concentration of a specific antibody in the blood of an individual was measured at various times over a period of 50 days. The results obtained are shown in the data table below.

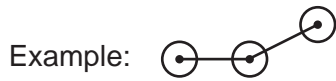
Antibody Concentration in an Individual

Day	Antibody Concentration in Arbitrary Units (arb. units)
5	0
10	110
16	120
25	10
35	200
45	390
50	200

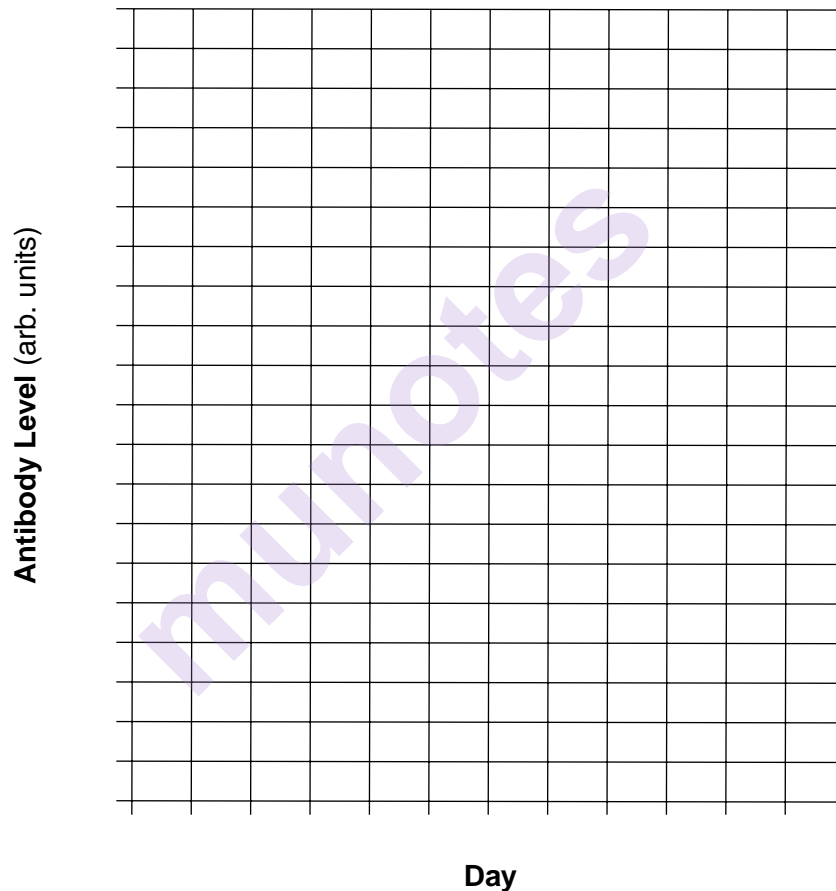
Directions (44–45): Using the information in the data table, construct a line graph on the grid, following the directions below.

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

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



Antibody Concentration in an Individual



46 State *one* reason for the change in antibody production during the first 10 days. [1]

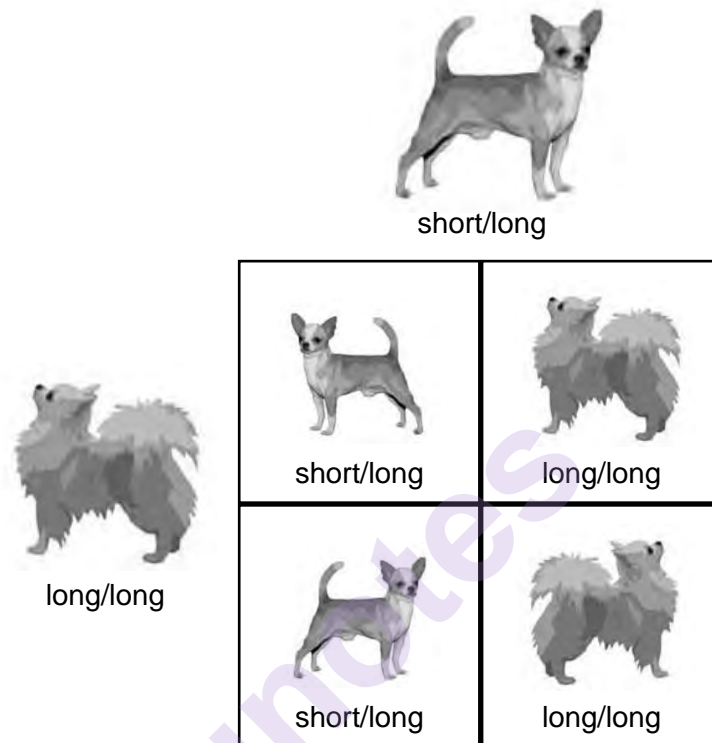
Note: The answer to question 47 should be recorded on your separate answer sheet.

47 The antibody level (in arb. units) of the individual on day 30 is closest to

- | | |
|--------|---------|
| (1) 30 | (3) 110 |
| (2) 70 | (4) 160 |

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

If a Chihuahua with short hair has a hidden gene for long hair, it can produce both long-haired and short-haired puppies when bred to a Chihuahua with long hair.

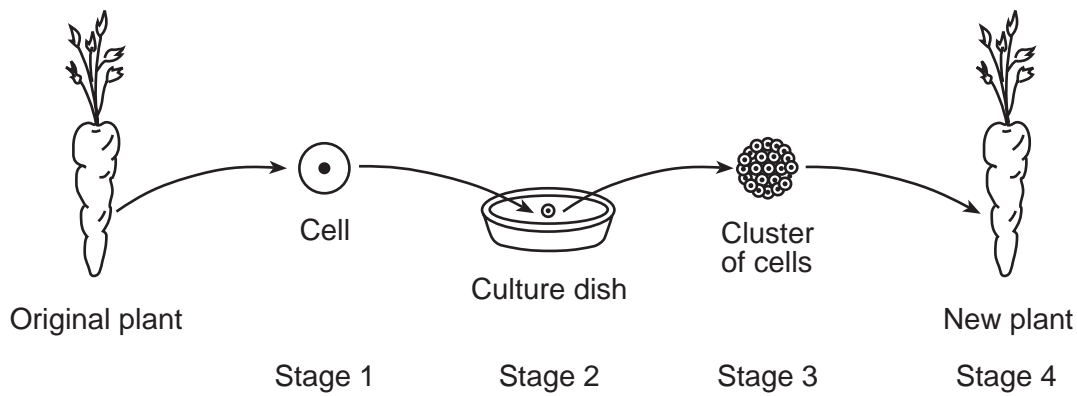


- 48 A family decides that they want to produce Chihuahuas with long hair. Identify a procedure that could be used to make sure that the puppies all have long hair. [1]

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

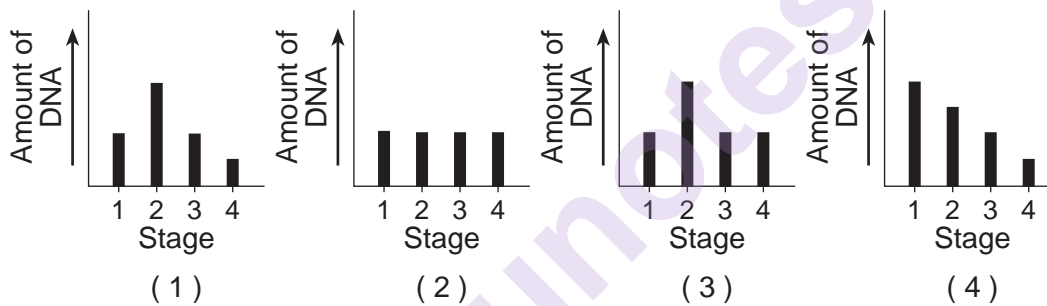
- 49 A Chihuahua is born having a trait that is different from either of its parents. A possible explanation for the difference is that the Chihuahua puppy
- (1) was produced as a result of the recombination of genes during sexual reproduction
 - (2) was produced as a result of the process of asexual reproduction
 - (3) inherited a gene from one of its grandparents and not its parents
 - (4) had a mutation that occurred after it was born
-

Base your answers to questions 50 and 51 on the diagram below and on your knowledge of biology. The diagram represents a technique used by scientists today to maintain the genetic makeup of an organism.



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

50 Which graph below best represents the DNA content found in each cell in each of the stages in the diagram above?



51 Describe *one* specific reason why scientists would want to maintain the genetic makeup of a particular plant. [1]

Base your answers to questions 52 and 53 on the information below and on your knowledge of biology.

Breast Cancer Research

Most deaths that are a result of breast cancer occur because the cancer cells metastasize (spread) from the breast to other organs. As they metastasize, cancer cells travel through the bloodstream.

MicroRNA molecules are involved in both the movement and control of metastasized cells. One microRNA, known as miR-7, shuts down a protein that helps cancer cells travel through the blood.

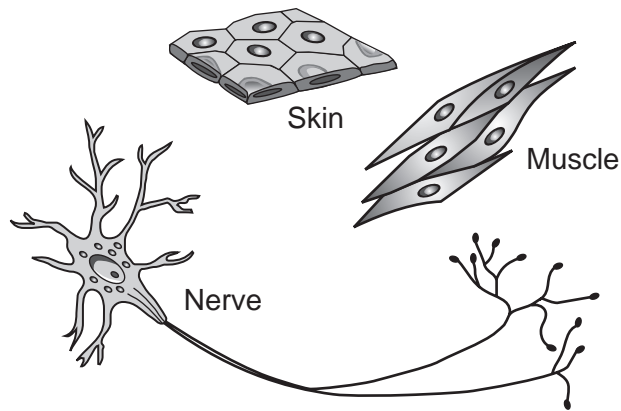
Understanding how miR-7 interacts with cancer cells may lead to new treatments for certain types of cancer. Since certain levels of miR-7 expression can also stimulate the development of cancer cells, the use of miR-7 to treat cancer will have to be studied in more detail. Researchers are hoping that eventually levels of miR-7 will be used to diagnose, treat, and prevent the spread of cancer in an individual.

52 State *one negative* effect of using miR-7 as the only treatment for breast cancer. [1]

53 State *one* way cancer cells are different from normal body cells. [1]

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

Each body cell contains the same genetic information, but can differ in appearance and size. The diagram below shows three different types of cells found in the human body.



54 Identify *one* similarity, other than the genetic information, that these body cells have. [1]

55 Explain why differences in these human body cells are a biological advantage. [1]

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 through 58 on the information below and on your knowledge of biology.

Owl vs. Owl



Barred owl



Spotted owl

Federal wildlife officials plan to dispatch armed bird specialists into forests of the Pacific Northwest starting this fall to shoot one species of owl to protect another that is threatened with extinction. ...

...“If we don’t manage barred owls, the probability of recovering the spotted owls goes down significantly,” said Paul Henson, Oregon state supervisor for Fish and Wildlife. The agency’s preferred course of action calls for killing 3,603 barred owls in four study areas in Oregon, Washington and northern California over the next four years. ...

...Mr. Henson said unless barred owls are brought under control, the spotted owl in coming decades might disappear from Washington’s northern Cascade Range and Oregon’s Coast Range, where the barred owl incursion [takeover] has been greatest.

The northern spotted owl was listed as a threatened species in 1990. Barred owls are bigger, more aggressive and less picky about food. Barred owls now cover the spotted owl’s range, in some places outnumbering them as much as 5-to-1.

Source: Associated Press, 7/26/13

56 Describe how the barred owl population is having a *negative* effect on the spotted owl population. [1]

57 Explain why it is important to protect the spotted owl from extinction. [1]

58 Certain groups oppose the plan to kill barred owls, in part because they feel it will not solve the problem. They recommend that the focus should be on protecting the habitat of the spotted owl. Describe the role that the habitat plays in the survival of an animal species such as the spotted owl. [1]

Base your answer to question 59 on the information below and on your knowledge of biology.

The 1990 Federal Clean Air Act requires New York State to conduct an emissions test on most gasoline-powered automobiles in order to help reduce harmful emissions. Vehicles that fail this test must be repaired and pass inspection before they can be driven on the road. Some people did not support this legislation.

59 State *one* advantage and *one* disadvantage of automobile emission testing. [1]

Advantage: _____

Disadvantage: _____

Base your answers to questions 60 through 63 on the information below and on your knowledge of biology.

Enzyme Investigation

An enzyme was isolated from digestive juices taken from the small intestine. An experiment was set up to test the ability of the enzyme to break down protein. Two test tubes, labeled *A* and *B*, were placed in a hot water bath at 37°C, human body temperature.

Test tube *A* contained only protein and test tube *B* contained protein and the enzyme. The chart below shows the set-up.

Test Tube	Contents
A	protein
B	protein, enzyme

After two hours, the contents of both test tubes were analyzed. Test tube *A* showed only the presence of protein. Test tube *B* showed the presence of the end products of protein digestion, indicating the enzyme had successfully broken down the protein.

- 60 Identify the end products of protein digestion that made up the contents of test tube *B* after the two hours. [1]

- 61 Explain the importance of temperature in the functioning of enzymes. [1]

- 62 State what the result would be if the same enzyme that was added to test tube *B* was added to a test tube containing starch. Support your answer. [1]

- 63 In the digestive system many large molecules, such as proteins, are broken down into much smaller molecules. State what happens to these smaller molecules following digestion. [1]

Base your answers to question 64–66 on the information below and on your knowledge of biology.

Secondhand Smoke and Estrogen

A fertility researcher conducted a study of pregnant women. The researcher's hypothesis was that the estrogen levels of pregnant women who were exposed to daily secondhand cigarette smoke would be higher than estrogen levels of pregnant women not exposed to daily secondhand smoke.

The researcher measured the estrogen levels of eight pregnant women each week throughout their pregnancy. Four of the women lived in houses with heavy smokers, the other four did not. The women's ages varied from 19 to 42 years old. Six of the women were pregnant with girls, one was pregnant with a boy, and one was pregnant with twin boys. The research was submitted for peer review.

64–66 Analyze this experiment. In your answer, be sure to:

- identify *one* error in the researcher's experimental design [1]
- identify *one* way, other than affecting estrogen levels, that secondhand smoke could affect a developing embryo [1]
- explain why the process of peer review is an important step in this research [1]

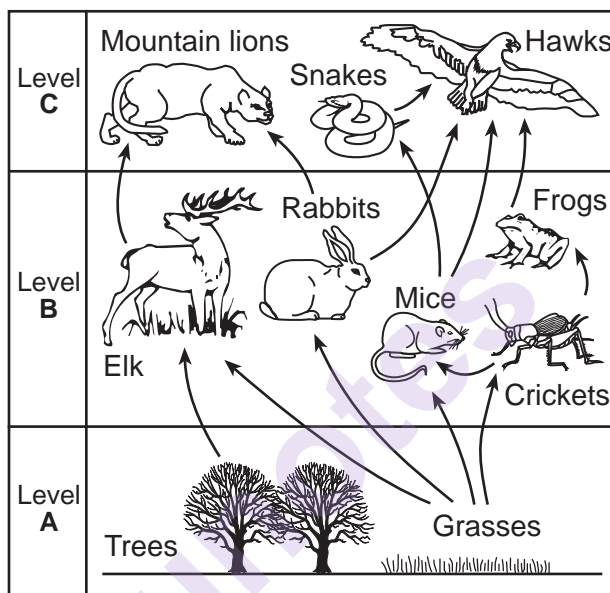
Base your answers to questions 67 through 69 on the information and passage below and on your knowledge of biology.

Snowy Owls Move to the South

Snowy owls are large white birds that normally inhabit the cold northern regions of Canada. Recently, scientists and birdwatchers have sighted the snowy owls much farther south than usual.

When snowy owls are in northern areas, they feed on lemmings (small rodents). When lemmings are not available, as in the areas further south, the owls will seek out mice or rabbits as their food source.

Several snowy owls migrated into an area represented by the food web below.



- 67 Identify *one* population of organisms shown in the food web, other than rabbits or mice, that would likely be affected by the introduction of the snowy owls and explain why their population would be affected. [1]

Population affected: _____

- 68 Identify *one* condition that might cause snowy owls to leave their usual habitat and move to another area. [1]

- 69 State which level, A, B, or C, contains the *least* total available energy. Support your answer. [1]

Level: _____

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

Pocket Mice

Pocket mice are small rodents that feed mainly at night and are preyed upon by owls, hawks, and snakes. Scientists studied pocket mice living on dark volcanic rock in both New Mexico and fifty miles away in Arizona. They recorded their data in the chart below.

Number of Mice on Dark Volcanic Rock				
Year	New Mexico		Arizona	
	Light Fur	Dark Fur	Light Fur	Dark Fur
2000	120	122	16	125
2001	140	136	8	140
2002	134	130	6	135
2003	115	120	12	115
2004	122	126	8	129

- 70 State *one* possible hypothesis that would explain the differences in the observed data between the two locations. [1]

- 71 Dark fur color in pocket mice is the result of a mutation. Scientists analyzed the sequence of bases in the gene known to play a role in fur color and discovered that the mutation was identical in both the New Mexico and Arizona mouse populations. Explain how it is possible for these two different populations to have identical gene sequences for dark fur color. [1]

- 72 Explain what is meant by the statement: “While mutations are random, natural selection is not.” [1]

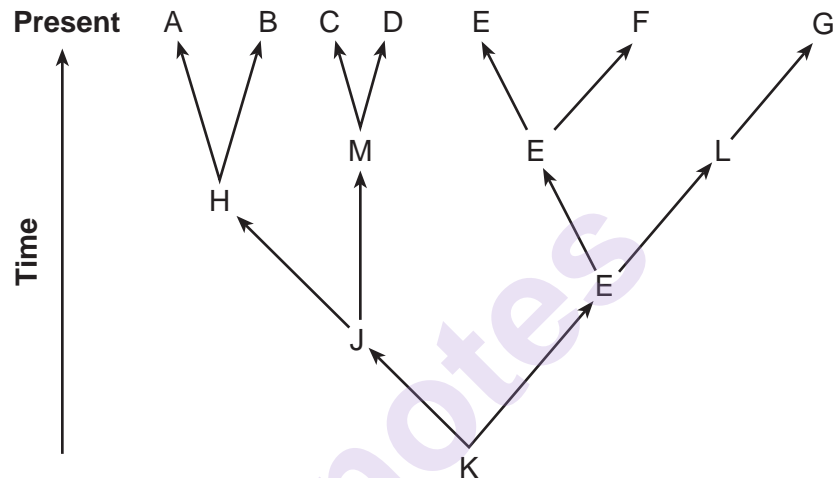
Part D

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.

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

73 The diagram below represents evolutionary pathways of seven groups of organisms alive today.



Which two living species would be expected to have the most similar proteins?

- | | |
|-------------|-------------|
| (1) A and C | (3) E and F |
| (2) B and C | (4) H and M |

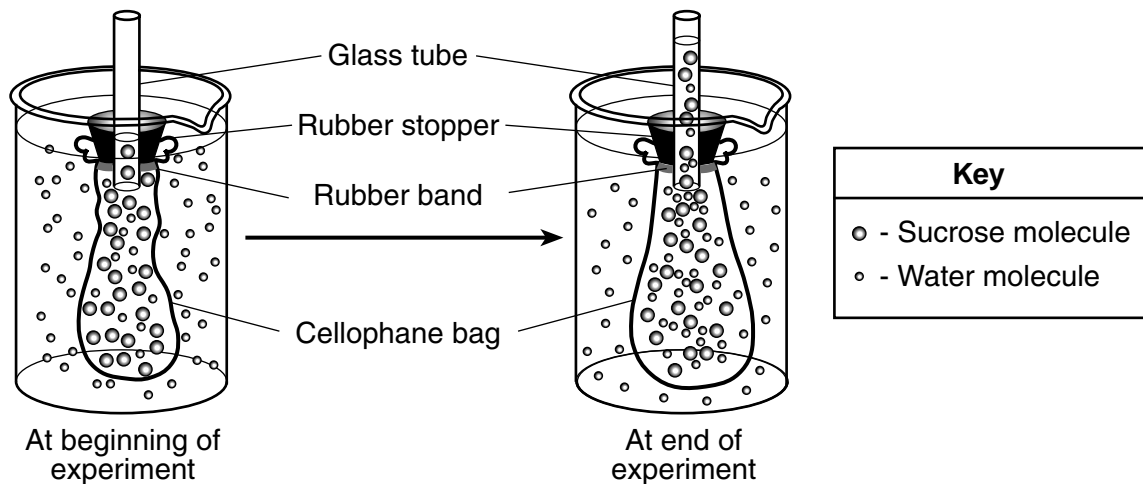
Note: The answer to question 74 should be recorded on your separate answer sheet.

74 Scientists recently discovered that three different types of squid, a marine animal, previously thought to be three different species, were actually all members of one species. Their earlier ideas were based on using squid carcasses (dead bodies). The new, more accepted classification is most probably based on an analysis of

- (1) a greater number of squid carcasses
- (2) the feeding habits of the three different species
- (3) a number of newly found squid fossils
- (4) the DNA present in the cells of squid

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

75 The diagram below represents a laboratory experiment involving sucrose and water molecules in a cellophane bag which functions in the same way as dialysis tubing.

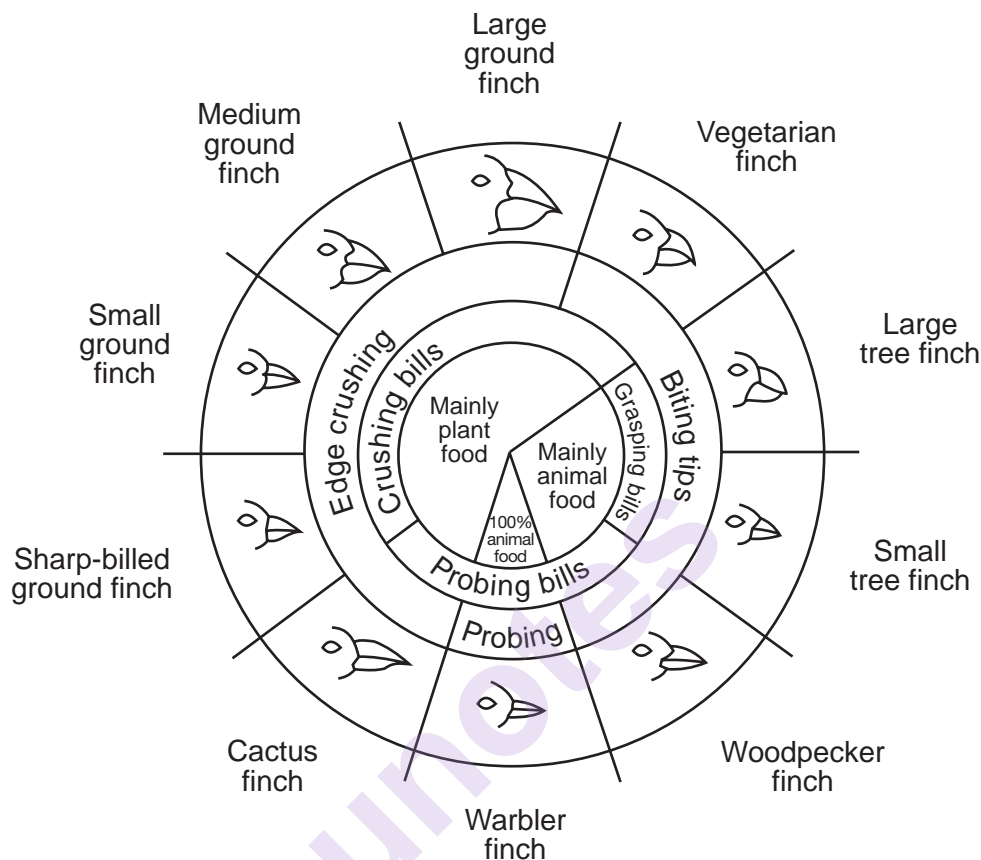


Which statement correctly explains the rise of liquid in the tube at the end of the experiment?

- (1) The concentration of sucrose molecules increased as water molecules entered the bag. This concentration increase pushed the liquid up the tube.
- (2) Water entered the bag due to the lower concentration of water inside. The extra water pushed the liquid up the tube as the bag filled.
- (3) Sucrose indicator entered the bag and reacted with the sucrose molecules. The reaction made the bag increase in size and pushed the liquid up the tube.
- (4) Sucrose molecules moved out of the bag and up the tube while water moved out, causing the rise of liquid in the tube.

Base your answers to questions 76 through 78 on the diagram below that shows variations in the beaks of finches in the Galapagos Islands and on your knowledge of biology.

Variations in Beaks of Galapagos Islands Finches



from: *Galapagos: A Natural History Guide*

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

76 Which row correctly pairs a finch species with its primary nutritional role and bill type?

Row	Finch	Bill Type	Nutritional Role
(1)	cactus finch	probing bill	carnivore
(2)	medium ground finch	grasping bill	herbivore
(3)	large tree finch	crushing bill	herbivore
(4)	warbler finch	probing bill	carnivore

77 In certain years, the Galapagos plants produce many tube-shaped flowers rich in nectar. Identify the finch that is best adapted to feed on the nectar within those flowers. Support your answer. [1]

78 The number of small tree finches is increasing on an island inhabited by a large population of small ground finches. State *one* reason why the population of small ground finches has *not* been affected by the increasing number of small tree finches. [1]

79 Explain why glucose molecules can cross a cell membrane and starch molecules can *not*. [1]

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Base your answers to questions 80 through 82 on the information below and on your knowledge of biology.

Progressive Resistance Exercise

Progressive resistance exercise (PRE) is a method of increasing the ability of muscles to generate force. The principles of PRE for increasing force production in muscles have remained unchanged for almost 60 years. These principles are (1) to perform a small number of repetitions until fatigued, (2) to allow sufficient rest between exercises for recovery, and (3) to increase the resistance as the ability to generate force increases. Traditionally, PRE has been used by young, healthy adults to improve athletic performance.

A student decided to incorporate PRE into his exercise program. He did not know how to determine when he had allowed sufficient rest between exercises for recovery. He hypothesized that waiting for his pulse to return to normal would probably be a good indication.

- 80 Explain why allowing his pulse rate to return to normal might be a good indication that he had waited long enough for recovery. [1]

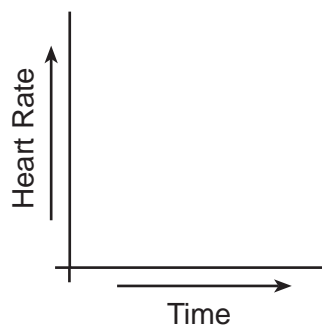
Note: The answer to question 81 should be recorded on your separate answer sheet.

- 81 Students wanted to try PRE to increase their ability to rapidly squeeze a clothespin. They thought if they could do this, they could challenge another class to a clothespin squeezing competition and win. Which steps should the students take to follow the principles of PRE?
- (1) Measure their pulse rate after squeezing the clothespin until fatigued. Then increase the resistance of the clothespin for the next trial.
 - (2) Squeeze a clothespin until fatigued, rest, and repeat. Over time, they should gradually increase the resistance of the clothespins they are squeezing.
 - (3) Measure their pulse rate, squeeze a clothespin for one minute, rest, and measure their pulse rate.
 - (4) Squeeze a clothespin for as long as they can, measure their pulse rate, rest, eat some candy. Increase the resistance of the clothespin for the next trial.

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

- 82 Students following the principles of PRE monitored their ability to lift weights. Which observation would indicate that their exercise program was successful?
- (1) They could eventually lift heavier weights than when they started.
 - (2) Their pulse rate increased more rapidly as they kept lifting weights.
 - (3) The number of weights their group could lift during competition decreased.
 - (4) Males and females could lift the same weight an equal number of times during competition.
-

- 83 Using the axes on the graph below, sketch a line graph showing the changes in heart rate of a person who is walking slowly, then begins running, and then sits down to rest for a few minutes. [1]



- 84 Identify *one* waste product that is released during exercise. Explain how this waste product leaves the body. [1]

Waste product: _____

- 85 State *one* way scientists could use the banding patterns produced by gel electrophoresis. [1]

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