The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Monday, January 22, 2018 — 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 OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

Answer all questions in this part. [30]

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

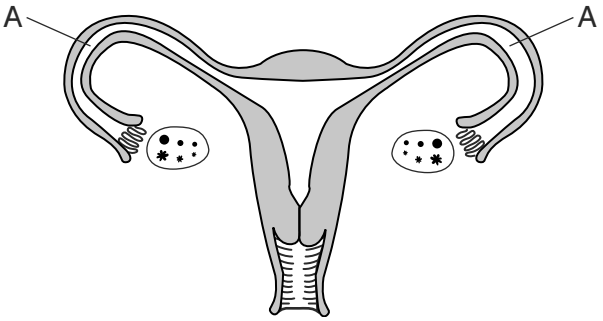
1 Which organisms and set of characteristics are correctly paired?

(1) fungi—carry out photosynthesis and heterotrophic nutrition
(2) plants—carry out respiration and autotrophic nutrition
(3) decomposers—carry out photosynthesis and autotrophic nutrition
(4) animals—carry out autotrophic nutrition and heterotrophic nutrition

2 Humans have an effect on ecosystems when they use native grasslands or forested areas for farming or urban use. One *negative* effect of these changes on the ecosystem is that there will be

(1) less biodiversity
(2) more homes
(3) successful economic growth
(4) increased food production

3 The diagram below represents structures found in the female reproductive system.



If the areas labeled *A* were completely blocked on both sides, the most likely result would be that

(1) egg and estrogen production would stop
(2) sperm and insulin production would stop
(3) fertilization would not occur
(4) an embryo would develop

4 Scientists have studied oceanic plastic garbage "patches" around the world. These are areas that accumulate plastic garbage from coastal regions. Their environmental effect ranges from killing sea life to blocking sunlight from reaching photosynthetic organisms. Without a change in human plastic usage, new garbage patches will continue to form. Which human activity would most directly *reduce* the amount of plastic garbage that enters the ocean?

(1) Ban the production and usage of all bags made from recycled plastic.
(2) Clean up plastic trash from shorelines, rivers, and other waterways that flow into the oceans.
(3) Manufacture fewer reusable water bottles, so that people will be more likely to use disposable ones.
(4) Implement a glass bottle deposit system to discourage people from recycling plastic bottles.

5 Monarch butterflies migrate from the U.S. and Canada to Mexico every winter. Over the past 10 years, there has been a drastic decrease in the number of monarch butterflies. Scientists have estimated that the population may have decreased from about 1 billion to 35 million. Which action would *not* be considered a reason for the decline in monarch butterfly populations?

(1) illegal deforestation
(2) extreme temperature changes
(3) decreasing food supplies
(4) habitat preservation

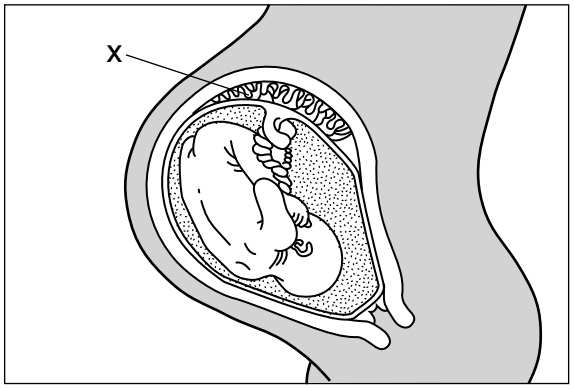
6 Finches on the Galapagos Islands express a variety of traits. Variability in the offspring of these finches is a result of

(1) mutation and cloning
(2) meiosis and mutation
(3) mitosis and asexual reproduction
(4) mitosis and genetic recombination

7 Exposure to certain environmental toxins, such as pesticides, may reduce fertility in males by interfering with their ability to produce gametes. These toxins are most likely having an effect on the

(1) testes and progesterone
(2) ovaries and testosterone
(3) ovaries and estrogen
(4) testes and testosterone

8 Which statement best describes an important process carried out by structure *X*?



(1) Milk passes from the mother to the fetus.
(2) Materials are exchanged between fetal and maternal blood.
(3) Maternal blood is converted into fetal blood.
(4) Oxygen diffuses from fetal blood to maternal blood.

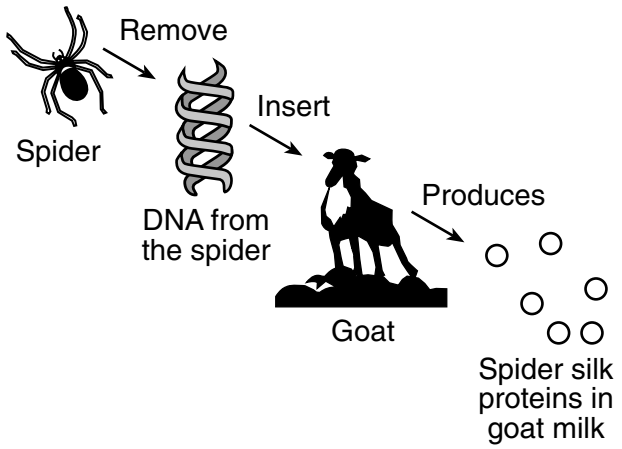
9 Traditional lightbulbs are only 10% efficient. Ninety percent of the energy they use is converted to heat. Modern lightbulbs are much more efficient, but may cost three times as much as traditional lightbulbs. Consumers who switch to modern lightbulbs are most likely

(1) spending more money for no good reason
(2) trying to stop pollution of the oceans
(3) trading a short-term cost for long-term savings
(4) helping traditional lightbulb factories employ people

10 Many oak trees are cut down and removed from an oak-hickory forest. A likely result of the direct harvesting of the oak species would be the

(1) disruption of natural cycles
(2) conservation of these natural forest resources
(3) recycling of all the nutrients in the forest
(4) prevention of the extinction of animals native to the area

11 A sequence of events is represented in the diagram below.



Which statement best describes a result of this process?

(1) The spider from which the DNA sample was obtained can no longer produce spider silk.
(2) The goat milk now contains DNA molecules made of spider silk proteins.
(3) Both the spider and the goat can now produce both spider silk and goat milk.
(4) Spider silk proteins can now be produced in large quantities without killing spiders to obtain them.

12 Which change is an example of a response to a stimulus?

(1) The pupil of an eye decreases in size in bright light.
(2) A leaf absorbs sunlight in the morning.
(3) The water level of a pond rises on a rainy day.
(4) A dead tree decays after many years.

13 After feeding at the surface of the ocean during the day, many ocean organisms migrate to deeper waters. While there, they release ammonia in their urine. Many bacteria use the nitrogen from the ammonia as they make amino acids, which eventually end up in food chains on both land and water. These amino acids may even be used in humans. Which statement best explains these observations?

(1) Chemical elements, including nitrogen, pass through food webs and are combined and recombined in different ways.
(2) Chemical elements, including nitrogen, are removed from food webs and eliminated from ecosystems.
(3) Nitrogen is transferred directly from bacteria to humans.
(4) All elements in the ocean remain there and are not transferred to other ecosystems.

14 Which statement describes an event that would most severely disrupt the process of ecological succession in an area?

(1) The season changes from spring into summer.
(2) Native plants are planted in an abandoned field.
(3) Plants and animals begin to colonize a newly formed volcanic island.
(4) A dam is built on a river to form a reservoir.

15 The processes of diffusion and active transport are both used to

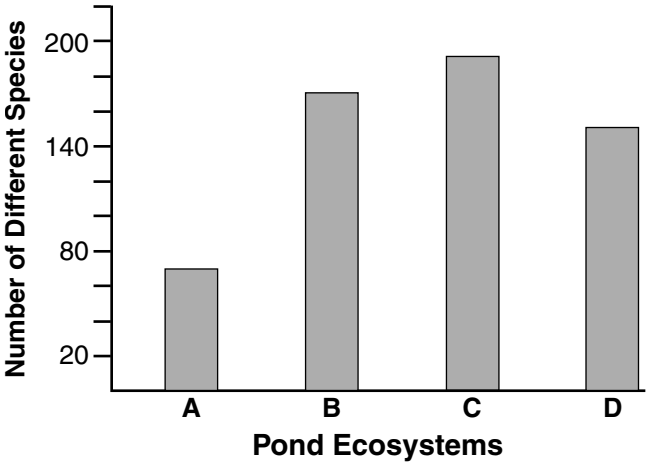
(1) break down molecules to release energy
(2) move molecules into or out of cells of the body
(3) bring molecules into cells when they are more concentrated outside of the cell
(4) move molecules against a concentration gradient, using ATP molecules

16 Botulinum toxin is a substance that can cause paralysis in humans. The effects of the toxin are due to the blocking of a signaling molecule that is necessary for communication between nerve cells. The toxin most likely interferes with the normal functioning of a

(1) chromosome
(2) DNA molecule
(3) receptor
(4) digestive hormone

17 The bar graph below shows the number of species in four pond ecosystems.

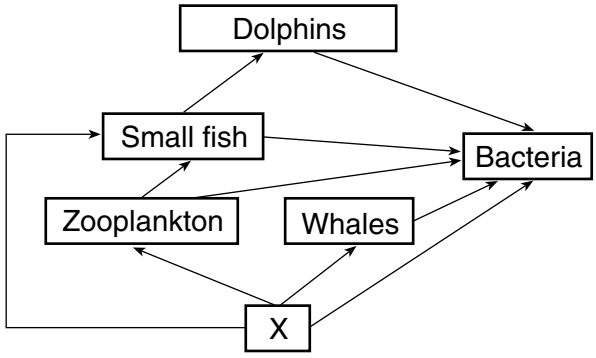
Number of Species in Four Pond Ecosystems



Based on this information, which ecosystem is likely to be the most stable?

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

18 The diagram below represents a marine food web.



The organisms represented by *X* are

(1) decomposers
(2) producers
(3) carnivores
(4) scavengers

19 When rain forests are cut down, there is a

(1) loss of fossil fuels that could be used by industry
(2) release of excess oxygen to the atmosphere
(3) release of chemicals which cause helpful mutations
(4) loss of genetic material available for research

20 Scientists who study rock formations in caves describe some of the formations as "living rock" because, under certain conditions, they increase in size. Which statement would best dispute the claim that these rock formations are living?

(1) Rocks are not composed of cells, while living organisms are.
(2) Rocks perform complex metabolic processes, but cannot grow.
(3) Rocks cannot reproduce sexually.
(4) Rocks remain stable in a wide range of physical conditions.

21 Carbon dioxide and oxygen are important resources in ecosystems and are

(1) recycled through the activity of living and nonliving systems
(2) stored in the animals of the ecosystem
(3) lost due to the activities of decomposers
(4) released by the process of photosynthesis

22 Before they can pass from a parent cell to its offspring cells, the inherited instructions that a human cell carries must first be

(1) moved into the nucleus
(2) broken down and made into DNA molecules
(3) used to make specific protein molecules that form genes
(4) accurately replicated

23 Eye color, hair color, and skin color often vary from person to person and even within a family. One explanation is that

(1) the glucose units in a DNA molecule are often rearranged
(2) the genetic material of the female parent has the most influence on offspring
(3) the inherited traits of individuals are determined by different gene combinations
(4) some extra parts of genetic material are often gained during fertilization

24 Organic compounds are used as building blocks for

(1) water, DNA, and starches
(2) water, proteins, and oxygen
(3) proteins, DNA, and carbon dioxide
(4) proteins, starches, and fats

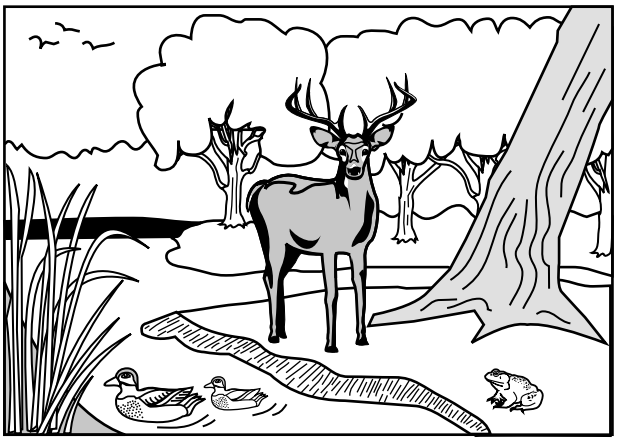
25 Scientists have developed the ability to manufacture hormones, such as human growth hormone, using bacteria. One benefit of this new technology is that

(1) scientists can use only one type of bacteria
(2) bacteria are relatively inexpensive and reproduce quickly
(3) patients can spend more money on their medications
(4) scientists produce drugs that cause more immune reactions

26 Although all of the cells of a plant contain the same genetic material, root cells and leaf cells are *not* identical because they

(1) use different genetic bases for the synthesis of DNA
(2) use different parts of their genetic instructions
(3) select different cells to express
(4) delete different sections of their enzymes

27 During cellular respiration, what is the direct source of the energy used in the cells of consumers in the ecosystem represented below?



(1) the Sun
(2) enzymes
(3) the atoms making up inorganic molecules
(4) the chemical bonds in organic molecules

28 Which dissolved substance do aquatic animals remove from their external environment for use in cellular respiration?

(1) carbon dioxide
(2) ATP molecules
(3) oxygen molecules
(4) nitrogen gas

29 The photographs below are of two Siamese cats.

Cat Kept Indoors

Source: Http://aboutmyrecovery.com/2008/12/13/my-very-own-siamese-pet-kitten/

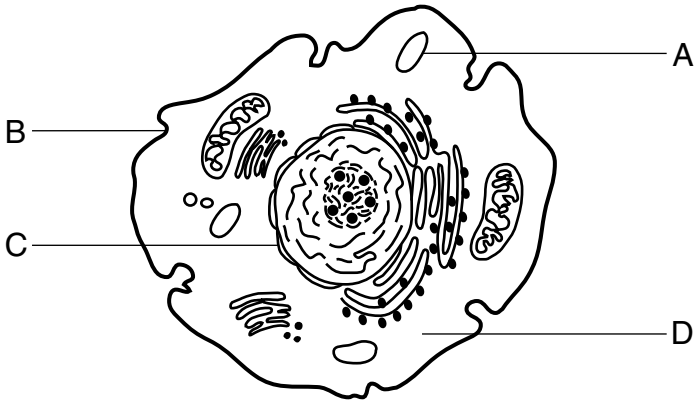
Cat Kept Outdoors

Source: Http://www.superstock.com/stock-photos-images/662-220

The Siamese breed has a gene that controls fur color. The cat in the first photograph was kept indoors while the cat in the second photograph was kept outdoors. Which statement best explains the differences in fur color between these two cats?

(1) The cat kept indoors is older than the cat kept outdoors.
(2) The environment influenced the expression of fur color genes.
(3) The environment influenced the production of all the proteins in the cat kept outdoors.
(4) The cat kept outdoors has a gene mutation that prevents it from producing light-colored fur.

30 The diagram below represents a cell.



Which letter indicates the specific structure where most hereditary mutations occur?

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

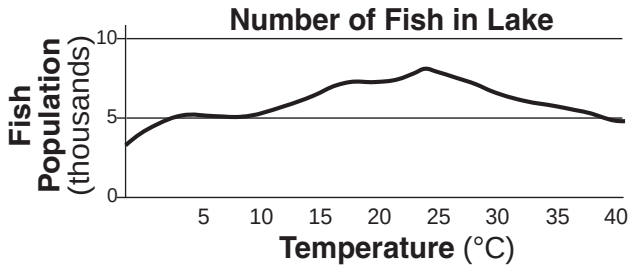
Part B–1

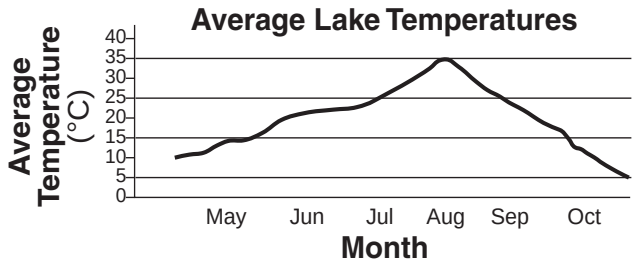
Answer all questions in this part. [13]

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 33 on the information and graphs below, and on your knowledge of biology. The diagrams below show the number of fish in a lake and the average water temperature in the lake for the months of May through October.

During certain times of the year, bears feed heavily on a population of fish in a lake. At other times of the year, the bear population feeds primarily on fruits, berries, and insects.





31 During which month would the bears in the area have the most fish available?

(1) May
(2) July
(3) August
(4) October

32 One of the best ways to represent the interdependence of all of the organisms in this ecosystem is

(1) an evolutionary tree
(2) a food chain
(3) an electrophoresis gel
(4) a food web

33 Within the fish population, variations exist in color, size, gamete production, and swimming speed. A variation that would most likely be passed on to future generations of the species is

(1) a swimming speed that is less than that of its predators
(2) the presence of bright, colorful markings that contrast with the lake bottom
(3) being of a size that enables them to hide among the rocks in the lake
(4) the production of a small number of gametes during the peak of the breeding season

Base your answers to questions 34 and 35 on the information below, and on your knowledge of biology.

Before conducting an experiment, two students gathered information about the effect of greenhouse gases on global warming. Student *A* found information in a newspaper article. Student *B* found information in several peer-reviewed scientific journals and on three websites.

34 Which statement most likely describes the reliability of the students' information?

(1) Information gathered by student *A* is more reliable because newspapers are always updated to reflect the most current research.
(2) Information gathered by student *B* is more reliable because some of it was gathered from peer-reviewed sources.
(3) Information gathered by student *A* is more reliable because it is from a single source without conflicting information.
(4) Information gathered by student *B* is more reliable because some of it was found on the internet.

35 After gathering the information, the students presented the information to their class. The class gave the students suggestions about how to continue with their experiment. How does this step benefit the investigation?

(1) Feedback from the class will help them design a better experiment.
(2) Feedback creates confusion, and will complicate the investigation.
(3) The students' investigation will be unaffected because the class is not carrying out the experiment.
(4) The investigation will be unchanged because students can use information only from published sources to design the experiment.

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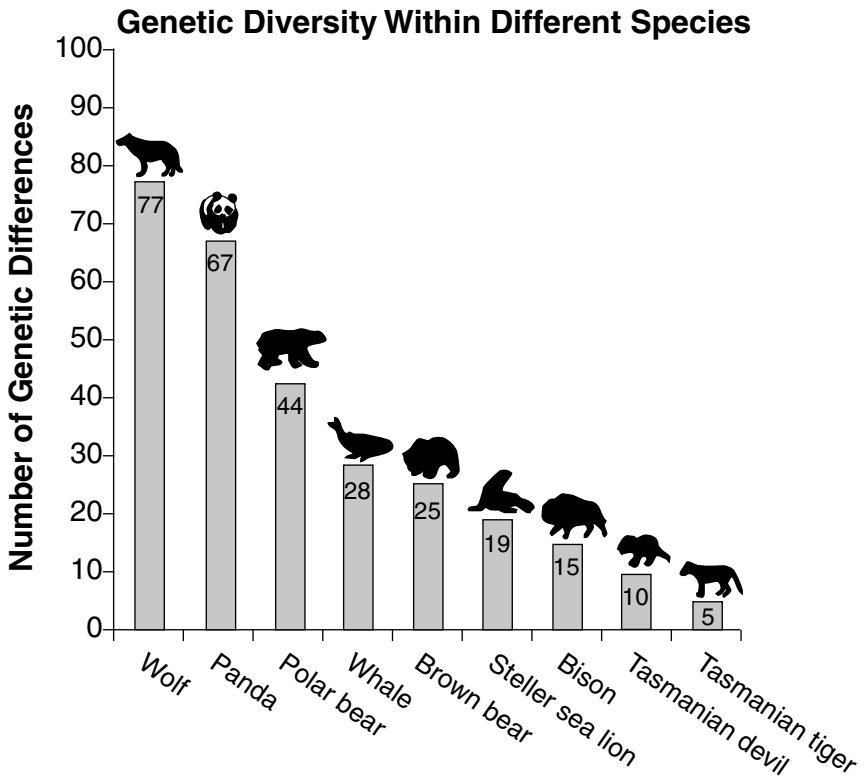
36 A student wondered if butterflies would show any differences in their wing color if, as caterpillars, they were grown in the dark or grown in bright white light. Which statement would be a possible hypothesis for an experiment to test this idea?

(1) Caterpillars exposed to bright white light will show more blue and green in their wings when they become butterflies than caterpillars kept in the dark.
(2) Will caterpillars kept in the dark have brighter wings when they become butterflies than caterpillars exposed to bright white light?
(3) Ten caterpillars will be kept in the dark and ten caterpillars will be exposed to bright white light and allowed to develop into butterflies.
(4) Results show that caterpillars kept in the dark and those exposed to bright white light had the same wing color when they became butterflies.

37 The chart below shows the number of differences in genetic material between individuals within the same species. Scientists can use this information to determine which populations demonstrate the greatest amount of genetic diversity.



adapted from: www.pnas.org

According to the chart, which two species would be more likely to survive if their environmental conditions changed?

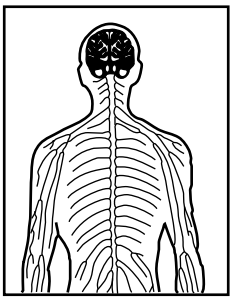
(1) Tasmanian tiger and Tasmanian devil
(2) brown bear and whale
(3) Tasmanian tiger and wolf
(4) panda and wolf

38 Microbeads are tiny, smooth, plastic spheres found in common household products such as facial soap. These beads, measuring from 0.0004 to 1.24 mm, roughly the size of some fish eggs, are too small to be removed by water treatment systems. Thus, they end up in rivers, lakes, and other bodies of water. The accumulation of these microbeads is an environmental concern for aquatic biologists because microbeads

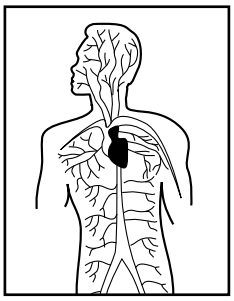
(1) make the lakes and rivers cloudy and dirty, affecting their appearance
(2) may stick to some household water pipes, preventing drainage problems
(3) could be mistaken for food by some species, working their way up the food chain
(4) could clog fishing nets, affecting the ability of fishermen to catch fish

Base your answers to questions 39 and 40 on the diagrams below and on your knowledge of biology. The diagrams represent some of the systems that make up the human body.

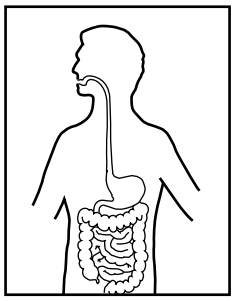
System A



System B



System C



System D

39 Which row in the chart below correctly identifies the main function of these systems?

Row	System A	System B	System C	System D
(1)	response	excretion	circulation	digestion
(2)	movement	response	circulation	digestion
(3)	response	circulation	excretion	digestion
(4)	movement	circulation	digestion	reproduction

40 A similarity between these systems is that they all

(1) are made of cells that are identical in structure and function
(2) contain organs that work independently from other organs in that system
(3) work together to maintain a stable internal environment
(4) are separate and do not interact with other body systems

Base your answer to question 41 on the information below and on your knowledge of biology.

In China, farmers switched from growing conventional cotton, which required spraying with insecticides 15 times each year, to a genetically modified cotton variety called Bt cotton. The Bt cotton produces a protein toxic to the insects that destroy the cotton crop. Since the switch to Bt cotton, the use of chemical insecticides has decreased by 60%.

41 An advantage of growing the genetically modified Bt cotton instead of conventional cotton is that growing Bt cotton could

(1) result in an increase in populations of insects that are beneficial
(2) result in an increase in the size of insect populations that are resistant to the Bt protein
(3) lead to an increase in the survival rates of insects that eat cotton
(4) lead to an increase in the use of insecticides that protect cotton from insects

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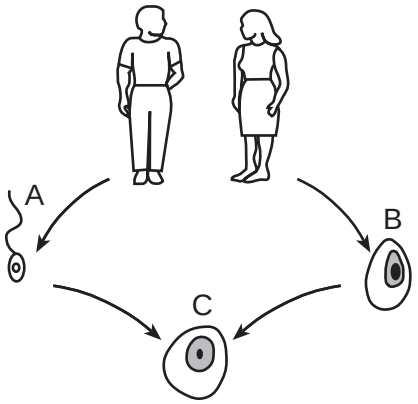
42 The diagram below represents events that occur during sexual reproduction.



The stages labeled *A*, *B*, and *C* are necessary to ensure that the offspring will inherit

(1) half of their chromosomes from each parent
(2) double the amount of chromosomes from each parent
(3) pairs of chromosomes from each parent
(4) double the amount of chromosomes from one parent

43 A company that produces paint is planning to build a small factory in a rural community. The factory would provide many needed jobs. Before the community agrees to allow the factory to be built, the community should

(1) investigate the use of paint as a method of biological control
(2) consider just the economic advantages of building the new factory
(3) assess the risks of the new factory and compare these to the benefits
(4) insist the factory use finite resources located in the community

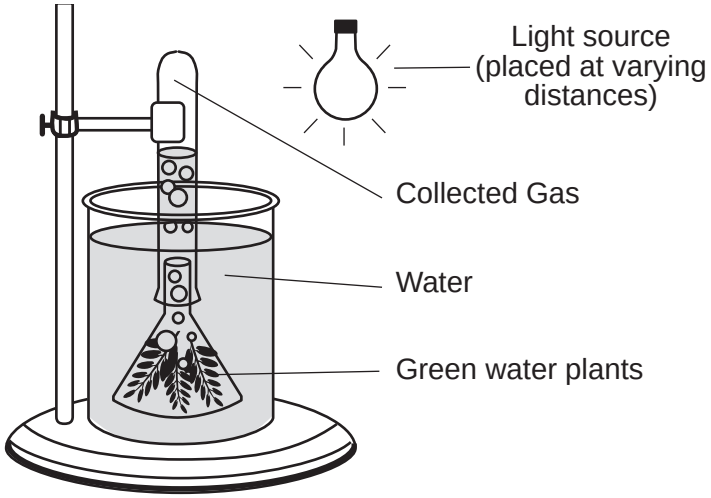
Part B–2

Answer all questions in this part. [12]

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

Base your answers to questions 44 through 48 on the information, diagram, and data table below and on your knowledge of biology.

The laboratory setup represented below was used to investigate the effect of light on aquatic plants. Equal amounts of a green water plant were placed in beakers with gas-collecting tubes. The beakers were placed in a temperature-controlled environment. The light source was placed at different distances from the beakers. After an hour, the amount of gas collected from the plants in each tube was measured and recorded in the data table.



Basic Setup

Gas Collected with Light Source at Different Distances from Plant

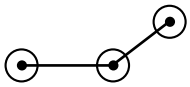
Distance of Light Source from Plant (cm)	**Gas Collected in Tube** (mm)
5	85
10	37
15	15
20	8
25	5

Directions (44–46): Using the information given, construct a line graph on the grid following the directions below.

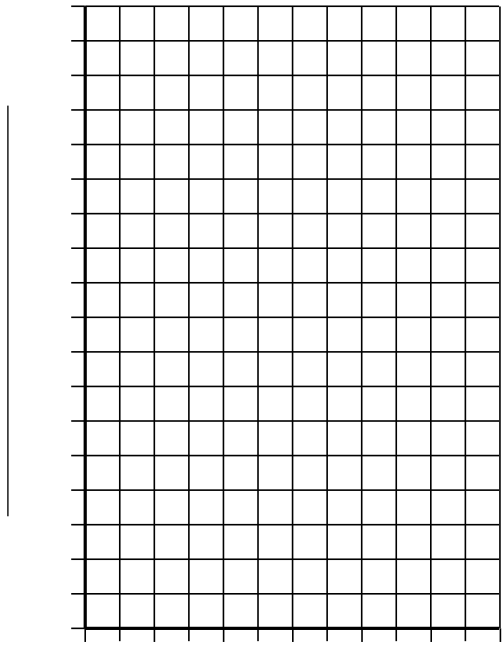
44 Provide an appropriate label for the *y*-axis, including units, on the line provided. [1]

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

46 Plot the data on the grid, connect the points, and surround each point with a small circle. [1]

Example: 

Gas Collected with Light Source at Different Distances from Plant



Distance of Light Source from Plant (cm)

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

47 Which row in the chart below correctly identifies the variables in this experiment?

Row	Independent Variable	Dependent Variable
(1)	amount of gas collected	distance of beaker from light source
(2)	number of plants in the beaker	temperature of plant
(3)	distance of beaker from light source	amount of gas collected
(4)	minutes of exposure to the light source	rate of gas collection

48 Identify the gas being produced by the plants. [1]

Base your answers to questions 49 through 51 on the information below and on your knowledge of biology.

The Bionic Pancreas

Until recently, diabetics could rely only on regular blood sugar checks, medications, and low-carbohydrate diets in order to maintain their health.

Bioengineers at Boston University are working to create a bionic pancreas. The device includes a sensor implanted just beneath the skin that monitors blood sugar levels. It sends a wireless signal to a smartphone every five minutes. If the phone receives a signal that blood sugar is too low or too high, it then sends a different signal to a separate device also attached to the body. This device releases the appropriate hormone into the bloodstream to return blood sugar levels back to normal.

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

49 According to the passage, the bionic pancreas makes corrective actions that return blood sugar levels back to normal. This artificial device helps

(1) produce more sugar
(2) break down blood cells
(3) maintain homeostasis
(4) cure their diabetes

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

50 The corrective actions made by the bionic pancreas on a regular basis in response to changing blood sugar levels are similar to which natural biological process?

(1) a feedback mechanism
(2) an immune response
(3) biochemical digestion
(4) ATP production

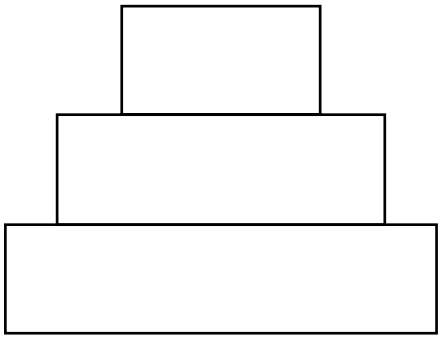
51 The bionic pancreas sends a signal to a device to release hormones into the bloodstream to regulate blood sugar. Identify *one* hormone the device would most likely release. [1]

52 Many hormones are proteins used in cellular communication. Each hormone carries a specific message to specific target cells. State why each of these hormones is able to deliver a different message. [1]

53 Two different species occupy the same habitat. Identify *one* reason these two species might *not* compete. [1]

Base your answers to questions 54 and 55 on the diagram below and on your knowledge of biology. The diagram represents the energy in kilocalories (kcal) available at different feeding levels in a food chain.

54 Complete the energy pyramid provided below by writing herbivore, plant, and carnivore in the correct locations. [1]



Energy Pyramid

55 Explain why there is a different amount of energy represented at each level of this energy pyramid. [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 question 56–58 on the information below and on your knowledge of biology.

Reindeer Drool

The results of new research highlight interesting findings regarding reindeer and moose saliva. Both reindeer and moose feed on a type of grass called red fescue. Red fescue is usually dangerous to eat due to the presence of a fungus with which it has a mutually beneficial relationship. When the red fescue is eaten, the fungus produces a toxin that decreases blood flow in the legs of the moose and reindeer. This could result in the loss of their limbs.

Since many reindeer and moose successfully feed on red fescue, scientists wondered if their saliva gave them the ability to eat the grass without suffering from circulation problems. Scientists hypothesized that moose and reindeer saliva might detoxify the grass. To conduct their experiment, the researchers smeared reindeer and moose saliva on cut red fescue that contained the fungus. They learned that the saliva slowed the growth of this fungus and detoxified the grass. The results suggest that some animal species have evolved the ability to fight back against a plant's natural defenses.

56–58 Explain the benefit of the ability moose and reindeer have to eat red fescue grass. In your answer, be sure to:

- explain why red fescue plants with the fungus normally have an advantage over red fescue plants without the fungus [1]
- explain how the moose and reindeer saliva protects them from the harmful effects of the fungus [1]
- explain how moose and reindeer (two separate, but related, mammals) could possess the same adaptation that protects them from the toxin produced by the fungus [1]

59 Cancer of the ovary is not common, but when it occurs, the cancer can cause the ovary to malfunction. Identify *one* possible result of an ovary *not* performing its intended function in the body. [1]

60 Several students were diagnosed with strep throat. They were all given the same antibiotic and took it for the time specified. Three weeks later, after finishing all their antibiotic, all the students except one no longer had strep throat. State *one* likely reason why the one student was still infected with strep bacteria. [1]

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

Project Frozen Dumbo – Saving the Elephant Population Means Using Special Breeding

Over the last 10 years, 70 percent of Africa's wild elephant population has been killed off. The main cause is ivory poaching, in which elephants are slaughtered for their valuable tusks. At the same time, efforts to breed captive zoo elephants have not been very successful.

Now there is some good news. At zoos in Austria and England, two baby elephants were born, using sperm from South African wild elephants. For the first time, elephant sperm gathered in the wild was frozen and given to zoos. Two female zoo elephants were artificially impregnated with the sperm and went on to deliver calves. …

Source: Saving the Elephant Population Means Using Special Breeding, Pittsburgh Post-Gazette, 8/21/14

61 State *one* reason why the use of sperm from wild elephants, rather than the use of sperm from elephants in zoos in England or Austria, would be more important to the long-term survival of elephants. [1]

62 Identify o*ne* likely reason, other than poaching and hunting, for the decline of the elephant population. [1]

Base your answers to questions 63 through 65 on the information below and on your knowledge of biology.

Battling Cancer with T-cell Therapy

One reason that cancer is able to spread through tissues and organs is that cancer cells are actually the patient's own cells. The immune system of the patient does not recognize these cancer cells as foreign and, therefore, does not reject and destroy them.

Over the past eight years, immunologists have been developing a treatment for B-cell leukemia that involves using genetically engineered T cells to recognize and destroy B cells, all of which carry a protein, CD19. CD19 is found on the surface of both healthy and cancerous B cells. B cells are immune system cells that produce antibodies.

The procedure used in this treatment is outlined below:

1. T cells are removed from the patient with B-cell leukemia.
2. The T cells are genetically engineered to recognize the CD19 protein.
3. The patient is injected with the engineered T cells, which attach to cells with CD19 and destroy them.
4. The engineered T cells destroy both cancerous and healthy B cells.

This procedure has been successful in several patients. Currently, studies are continuing with more B-cell leukemia patients. It is hoped that the studies will be expanded to include other types of cancer, and that this treatment will be available to treat a variety of cancers in the future.

63 Explain why these specific T cells can be used for B-cell leukemia treatment. [1]

64 Explain why a patient needs treatments of antibodies after being injected with these modified T cells. [1]

65 Explain why the engineered T cells taken from one cancer patient will *not* work as a cancer treatment if injected into another patient with B-cell leukemia. [1]

Base your answers to questions 66 through 68 on the information below and on your knowledge of biology.

Hydrothermal Vent Communities

Scientists discovered a unique hydrothermal ecosystem on the sea floor at hot-water vents thousands of feet below the ocean surface. Organisms in these deep-sea regions have no access to sunlight, so they depend on the heat, methane, and high levels of sulfur-bearing minerals found in the heated fluids in which they live. Scientists were amazed to discover vent communities able to sustain vast amounts of life. The vent organisms depend on bacteria that can use the sulfur-bearing minerals to produce organic materials. These bacteria live on rock surfaces and as free-floating blobs. Some bacteria live within and provide nutrients for an unusual species of giant tubeworms that lacks a digestive system. Snails, shrimp, and clams are among the animals that feed directly on the bacteria. Crabs feed directly on other animals in the vent community.

66 Identify *one* abiotic factor that makes the hydrothermal vent ecosystem different from other ocean ecosystems. [1]

_____

67 State the relationship that exists between the crabs and the other members of the vent community. [1]

_____

_____

68 Describe *one* way the bacteria of the hydrothermal vent community differ from plants in their ability to produce organic materials. [1]

_____

_____

Base your answers to questions 69 through 72 on the information below and on your knowledge of biology.

Transgenic Salmon

Transgenic Atlantic salmon have been produced using DNA from other species of related fish. These genetically modified fish have an altered DNA "switch" that causes them to overproduce growth hormone. The transgenic Atlantic salmon grow to normal size, but they reach market size in half the time of conventional Atlantic salmon. As with most of the salmon consumed by people, the transgenic Atlantic salmon would be grown using aquatic farming methods. Scientists have expressed concern that transgenic fish can have undesirable effects on the natural environment. Fish growers would be expected to take steps to ensure that the transgenic salmon do not escape into the wild.

69 State *one* advantage genetic modification has over selective breeding when producing new varieties of animals or plants. [1]

70 State *one* reason the scientists altered the DNA "switch" of the Atlantic salmon to make them produce more growth hormone, rather than directly supplying the Atlantic salmon with more growth hormone. [1]

71 State *one undesirable* effect that escaped transgenic Atlantic salmon could have on the natural environment. [1]

72 State *one* benefit of raising the transgenic Atlantic salmon. [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.

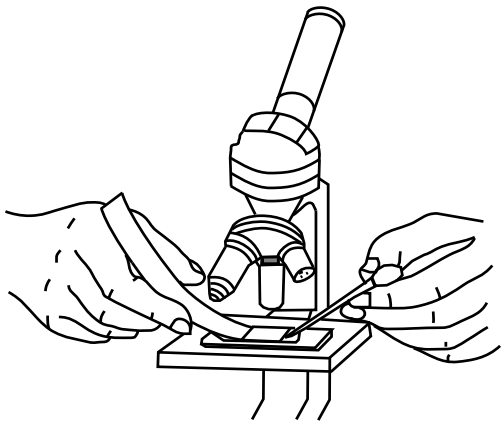
Note: The answer to question 73 should be recorded on your separate answer sheet.

73 During periods of vigorous physical activity, a person's breathing and heart rates increase. This enables the cells of the body to perform more efficiently because it helps the cells to

(1) remove waste products faster
(2) store excess glucose in muscles
(3) reduce the amount of ATP produced
(4) convert more oxygen to glucose

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

74 A step in a procedure used in the *Diffusion Through a Membrane* lab is represented in the diagram below.

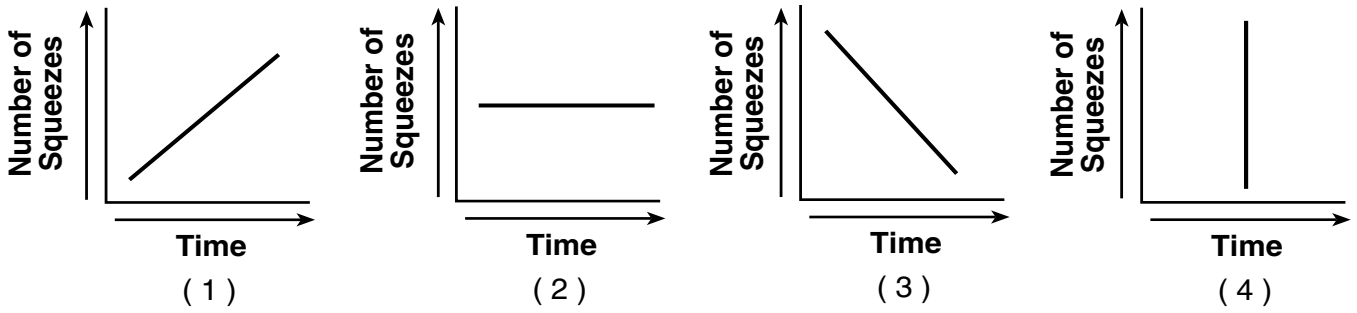


Which procedure is represented in the diagram?

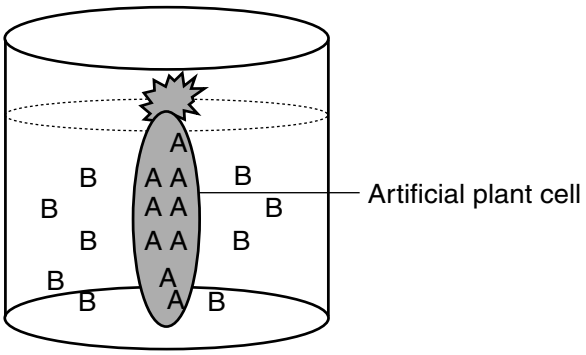
(1) adding distilled water to the top of a cover glass on a slide
(2) making an artificial cell
(3) adding salt solution to a specimen under the cover glass
(4) making a thin sample to prepare a slide of red onion cells

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

75 A student is opening and closing clothespins as part of a lab activity. The student begins to experience muscle fatigue, and the rate at which the student is opening and closing the clothespins slows. Which graph best represents the relationship between time and number of clothespin squeezes?



Base your answers to questions 76 and 77 on the information and diagram below and on your knowledge of biology. The diagram shows an experimental setup using an artificial plant cell.



Molecules *A* and *B* are commonly found in plant cells. When tested, it was discovered that molecule *A* quickly passed through the artificial plant cell membrane. Molecule *B* did not pass through.

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

76 The locations of molecules *A* and *B* at the beginning of the experiment are shown. Which statement best describes what was observed when the setup was examined 20 minutes later?

(1) Molecule *A* remained inside the artificial cell and molecule *B* remained outside.
(2) Only molecule *A* was found both inside and outside the artificial cell.
(3) Only molecule *B* was found both inside and outside the artificial cell.
(4) Both molecules *A* and *B* were found inside and outside the artificial cell.

77 State *one* way the two molecules could differ that would explain the difference in their ability to pass through the artificial plant cell membrane. [1]

Base your answer to question 78 on the information and diagram below and on your knowledge of biology. The diagram shows a plant called hogweed.

Hogweed is highly toxic and has become invasive in New York State. It can cause severe burns and blisters if touched.

Hogweed Plants

Source: http://www.washingtonpost.com

78 If you were given packaged samples of hogweed plant parts, describe *one* specific procedure you could use to determine if an unknown plant might be related to hogweed. [1]

Base your answers to questions 79 through 82 on the information and diagram below and on your knowledge of biology.

A human gene contains the following DNA base sequence: ACGCCCACCTTA

The gene mutated. It then contained the following DNA base sequence: ACGCGCACCTTA

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

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

79 In the table below, record the mRNA codons coded for by the DNA base sequence of the mutated gene ACGCGCACCTTA. [1]

80 Then, using the Universal Genetic Code Chart, record the amino acid sequence that is coded for by the mRNA codons you placed in the table. [1]

Mutated Gene DNA Base Sequence	ACG	CGC	ACC	TTA
mRNA codons	_____	_____	_____	_____
Amino acid sequence	_____	_____	_____	_____

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

81 Which type of mutation is represented in the new gene?

(1) addition
(2) deletion
(3) inversion
(4) substitution

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

82 The amino acids bond together to form which type of complex molecule?

(1) protein
(2) starch
(3) fat
(4) sugar

83 A certain small population of finches already has an "ideal" beak type for its present environment. Describe *two* specific adaptations, other than beak type, that would contribute to the ability of these finches to survive. [1]

84 In order to determine the effect of muscle fatigue on the ability of students to squeeze a clothespin, five male students did jumping jacks for three minutes and then squeezed a clothespin as many times as possible in a minute. Three other male students ran up and down the stairs for 30 seconds and then squeezed a clothespin as many times as possible for one minute. The results of the two groups were recorded. Identify *one* change that could be made to the experiment to increase the validity of the conclusion made from these results. [1]

85 There is a group of plants, known as halophytes, that has traits that enable them to survive in salty environments. Describe *one* change, other than death, that would be observed in the cells of a plant that did *not* have these traits and was planted in a salty environment. [1]

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