The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Thursday, August 17, 2023 — 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 After ingesting Vitamin D, the body converts it into a hormone that is transported throughout the body. This hormone affects cells in the intestines and bones. The reason that this hormone affects only certain cells in the body is because these cells have

(1) specific receptors
(2) antibodies
(3) specific organelles
(4) genes

2 Most scientists agree that a large asteroid struck Earth around 65 million years ago. The impact sent large amounts of fine dust particles into the atmosphere, which reduced the amount of sunlight reaching the planet. This event would have the most immediate effect on

(1) herbivores
(2) decomposers
(3) carnivores
(4) autotrophs

3 The photic sneeze reflex, an inherited trait, causes some people to sneeze when they are exposed to bright sunlight. In the photic sneeze reflex, the sunlight acts as

(1) the effect of an environmental factor resulting in a genetic trait
(2) a biotic factor being passed from parent to offspring
(3) an environmental factor stimulating a response
(4) the recombination of genes resulting from sexual reproduction

4 Difficulties often occur when tissues or organs are transplanted from one person to another because the

(1) transplanted structures cannot produce new cells
(2) rate of mitosis differs between the two people involved
(3) introduction of a foreign substance causes the formation of antibodies
(4) two people often have the same blood type

5 In humans, digestion depends on a variety of organs, such as the stomach, small intestine, and liver. The interactions of these organs provide evidence that

(1) each organ in the human body plays a role in only one life function
(2) organs in humans work together, resulting in the survival of the individual
(3) the most important life function in humans is the breaking down of food
(4) each life function is carried out by at least four different systems in humans

6 An example of how a plant maintains homeostasis includes

(1) producing many seeds for reproduction
(2) controlling the amount of available solar energy
(3) recycling energy from the Sun
(4) regulating the action of guard cells

7 Below is a list of events that might occur in a cell.

A – synthesis of a new protein
B – a cell function changes
C – alteration of the base sequence on a strand of DNA
D – exposure to radiation

Which is the correct sequence in which these events could occur?

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

8 The structures most directly involved in the synthesis of cellular proteins are the

(1) nucleus and ribosomes
(2) cell membrane and nucleus
(3) chloroplasts and cell membrane
(4) mitochondria and chloroplasts

9 Hydrangea, a commonly used landscaping flower, can have dramatically different colors, depending on the pH of the soil in which it is grown.

Hydrangea Flowers at Different pH Values

DEEP BLUE			PURPLE -PINK			DEEP PINK
4.5	5.0	5.5	6.0	6.5	6.8	7.0

Source: Adapted from www.espoma.com

The differences in color demonstrate that

(1) traits can be expressed differently if the environment changes
(2) flower color is controlled only by genetic information
(3) abiotic factors do not have an effect on flower production
(4) pH is the only factor that affects flower growth

10 Potato plants reproduce both sexually and asexually. Depending on the desired outcome, potato growers use both types of reproduction. A grower would most likely want the potato plants to reproduce asexually when

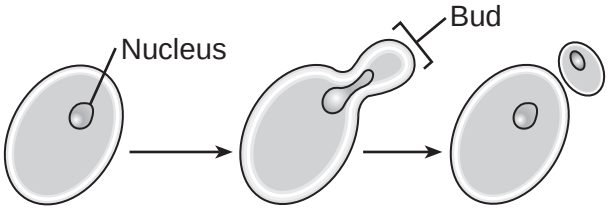
(1) selectively breeding new potato varieties
(2) there is a disease affecting similar potatoes growing in the area
(3) environmental conditions in the area are changing
(4) potatoes with the same traits are desired

11 Creatine, a popular nutritional supplement, is used to decrease fatigue by increasing ATP in muscle cells. The cell structure directly responsible for the increased production of ATP in human muscle cells is the

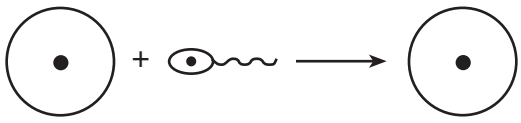
(1) chloroplast
(2) mitochondrion
(3) vacuole
(4) nucleus

12 Models *A* and *B* below illustrate two different methods of reproduction.

Model A



Model B



Which statement best describes the offspring that result from these methods?

(1) Both models *A* and *B* produce offspring that have fewer chromosomes than the parent cells.
(2) Both models *A* and *B* result in offspring that have more chromosomes than the parent cells.
(3) Model *A* produces offspring with genetic information different from the parent. Model *B* produces offspring that are genetically identical to the parents.
(4) Model *A* produces offspring with identical genetic information to the parent cells. Model *B* produces offspring that are genetically different from the parent cells.

13 As a population of organisms within a forest ecosystem increases, the size of the population is eventually limited by

(1) the overproduction of their food supply
(2) the size of similar populations in a nearby ecosystem
(3) a finite supply of water and nutrients
(4) a lack of competition

14 Solar and wind power are options available to people interested in producing electricity while reducing their reliance on fossil fuels. A benefit of using these alternative energy sources is that they

(1) preserve natural resources for future generations
(2) increase the number of jobs required for mining coal
(3) ensure that supplies of fossil fuels will never decrease
(4) cost more to generate than all other sources of electricity

15 Tourists travel to the Adirondacks in the fall to see the changing colors in the leaves of the trees. The leaves turn from green to many shades of red, yellow, and orange, as the chlorophyll slowly breaks down.

Source: www.lakegeorgeguide.com

A *decrease* in green chlorophyll in the chloroplasts will directly result in

(1) an increase in the glucose and oxygen produced
(2) a decrease in the glucose and oxygen produced
(3) an increase in the glucose and a decrease in the carbon dioxide produced
(4) a decrease in the glucose and an increase in the carbon dioxide produced

16 Which statement most accurately describes the expected effect on the carrying capacity of a population if a change in a factor occurs?

(1) The number of snowshoe hares would increase if the population of Canadian lynx, a predator, also increased.
(2) The population of green algae would increase if chemical weed killers used on lawns entered the lake.
(3) The grass population would decrease if the foxes ate many rabbits.
(4) The population of Kaibab deer in Arizona would decrease if they overgrazed the plants.

17 Powassan is a rare, tick-borne virus that is found in areas near the Great Lakes and the northeastern United States. The tick is not affected by the virus, but humans bitten by a tick carrying the virus will develop a serious illness. The risk of getting the Powassan virus is greatest in June and July. This information supports the concept that

(1) all viruses around the Great Lakes are spread by infected ticks
(2) this virus is harmful to all living organisms that it infects
(3) relationships between organisms may be negative, neutral, or positive
(4) time of year, alone, determines if infection with the Powassan virus is possible

18 Which two structures are directly involved in the normal development of a human fetus?

(1) uterus and placenta
(2) oviducts and ovaries
(3) testes and ovaries
(4) placenta and stomach

19 Which statement correctly describes an organism's genetic information?

(1) DNA molecules contain four subunits known as genes.
(2) Chromosomes are made entirely of protein.
(3) Genes are made of long sequences of chromosomes.
(4) DNA contains combinations of four base subunits.

20 Forest ecosystems help regulate climate, prevent soil erosion, and play a role in the cycling of water. Since the 18th century, humans have cleared nearly half of Earth's forests. Which statement best describes the effects of this deforestation?

(1) It affects only the species of animals that live there.
(2) It disrupts many natural processes that humans depend on.
(3) It increases plant biodiversity in nearby ecosystems.
(4) It increases human reliance on renewable resources.

21 The instructions for making an important protein in the blood-clotting process may be missing in some individuals. Scientists can now isolate these instructions and insert them into a yeast cell that will then produce the protein. Altering yeast cells in this way is known as

(1) selective breeding
(2) genetic engineering
(3) homeostatic regulation
(4) natural selection

22 Snake venom is modified saliva containing enzymes and other proteins that break down tissue surrounding the bite and destroy blood cells. If bitten, the damage caused by this type of venom would most likely be slowed by

(1) applying ice to the area where the patient was bitten
(2) having the patient drink a large amount of water
(3) forcing the patient to vomit, in order to remove the venom
(4) increasing the rate of blood flow by having the patient exercise

23 Which two processes are directly required for a human zygote to be produced?

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

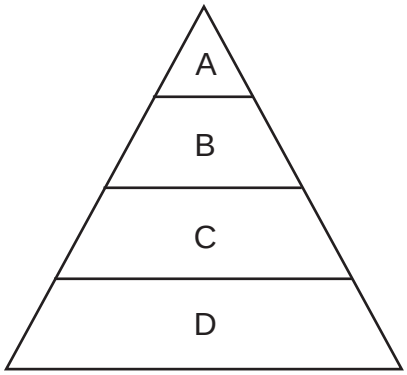
24 The element carbon and its compounds are constantly cycled between the living and nonliving parts of the ecosystem. This cycling is important because

(1) without carbon dioxide in the atmosphere, the ozone shield would break down completely
(2) carbon is a component of DNA, proteins, and other compounds essential for living organisms
(3) the process of photosynthesis releases carbon dioxide into the atmosphere, where it can be taken in by animals for the process of respiration
(4) carbon is required by humans to make all of the same proteins that all other mammals synthesize

25 Cane toads are native to parts of Central and South America. They were introduced to Australia in the 1930s to help control cane beetles. Cane toads have lethal toxins in their skin and release them from glands when attacked by predators. Cane toads disrupt food webs in Australia because they

(1) reduce populations of local species
(2) increase the stability of ecosystems
(3) preserve beetles that feed on crops
(4) provide a potential source of medicine

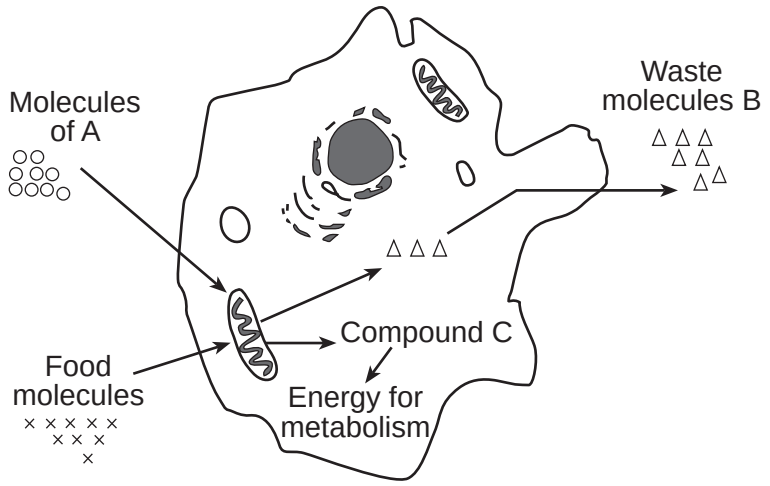
26 The diagram below represents an energy pyramid.



At which level do the organisms all carry on *both* respiration and photosynthesis?

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

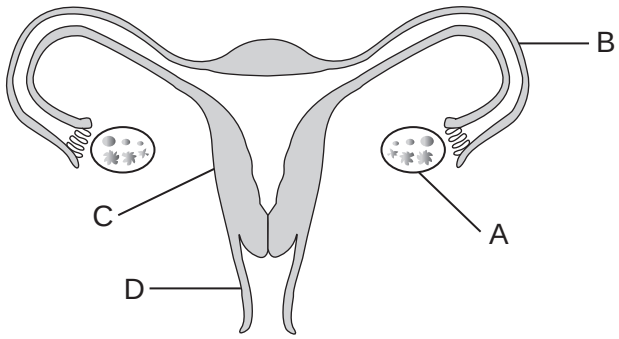
27 The diagram below represents some activities carried on by a single-celled organism.



This single-celled organism is maintaining homeostasis by

(1) limiting the number of the molecules of *A* that it excretes
(2) eliminating molecules of compound *B*
(3) excreting molecules of compound *C*
(4) using sunlight to increase the number of food molecules that it takes in

28 The diagram below represents the human female reproductive system.



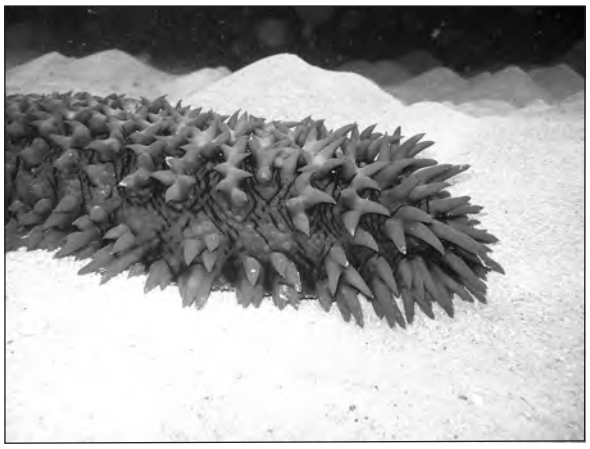
Which row in the chart correctly describes the normal function of *two* of the labeled structures?

Row	Structures and Their Functions
(1)	eggs are produced in A, and the fetus develops in B
(2)	meiosis occurs in A, and development occurs in D
(3)	fertilization occurs in B, and the placenta forms in C
(4)	fertilization occurs in D, and the fetus develops in C

29 A proposal for a new manufacturing plant has been brought to a town's planning board. A committee has been assigned the task of presenting the positive and negative effects that this new facility could have on the town and its ecosystem. Which row of the chart most accurately states possible effects of building this manufacturing plant?

Row	Positive	Negative
(1)	more jobs for residents	increased demand for energy
(2)	more space available for farming	people will have to move
(3)	increased use of fossil fuels	more pollution
(4)	more tax revenue for the town	decrease in the unemployment rate

30 The sea cucumber, a relative of sea stars and sea urchins, was once mostly ignored by humans. Even though no scientific evidence exists, some people believe that eating sea cucumbers has medical benefits. As a result, sea cucumbers that were once plentiful are now found in small numbers.



Source: https://farm3.staticflickr.com

Which statement most directly describes this situation?

(1) Sea cucumbers are an animal resource being appropriately managed to benefit humans.
(2) The population of sea cucumbers is being greatly reduced by natural predators, such as sea stars.
(3) The direct harvesting of organisms by humans can have irreversible effects.
(4) Biological research has led to the use of plant and animal products that have medical benefits.

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 answer to question 31 on the photographs below and on your knowledge of biology.

Mt. St. Helens erupted in 1980. The photographs represent the changing environment in the area of the Mt. St. Helens volcano in 1988 and 2001.

Mt. St. Helens 1988

Mt. St. Helens 2001

Source: https://www.tes.com/lessons/EYCSa5yDUpRu3A

31 Following the volcanic eruption in 1980, which process occurred that resulted in an increase in the number of species?

(1) ecological succession
(2) deforestation
(3) biological evolution
(4) differentiation

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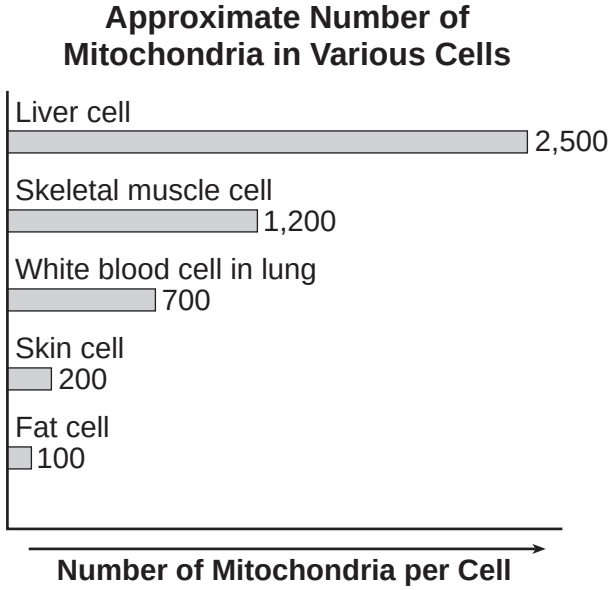
32 The table below shows data collected during an experiment conducted by Jan Baptista van Helmont in the 1600s. The soil was dried before all masses were taken.

	Start of Experiment	After Five Years of Growth
Soil mass (kg)	90.9	90.8
Willow tree mass (kg)	2.3	76.8

Which explanation is consistent with the data collected?

(1) The increased mass of the willow tree came only from materials taken in from the soil in which it was planted.
(2) The increased mass of the willow tree was the result of cellular respiration during the five-year period.
(3) The willow tree did not use any material from the soil during the five-year period.
(4) The increased mass of the willow tree was the result of the tree taking in materials from its environment.

33 The graph below provides information about the number of mitochondria in various types of cells.



Source: Adapted from What is Life? A Guide to Biology © 2012 W.H. Freeman and Company

Which type of cells most likely require the greatest input of oxygen?

(1) white blood cells
(2) skin cells
(3) fat cells
(4) liver cells

34 The news article below appeared in a New Zealand newspaper dated August 14, 1912:

COAL CONSUMPTION AFFECTING CLIMATE.

The furnaces of the world are now burning about 2,000,000,000 tons of coal a year. When this is burned, uniting with oxygen, it adds about 7,000,000,000 tons of carbon dioxide to the atmosphere yearly. This tends to make the air a more effective blanket for the earth and to raise its temperature. The effect may be considerable in a few centuries.

Source: https://www.livescience.com/63334-coal-affecting-climate-century-ago.html

The prediction in the news article, which was made over 100 years ago, may be considered

(1) accurate because the average global temperature has risen
(2) accurate because the average global temperature has lowered
(3) inaccurate because we don't burn coal today
(4) inaccurate because our carbon dioxide production has decreased

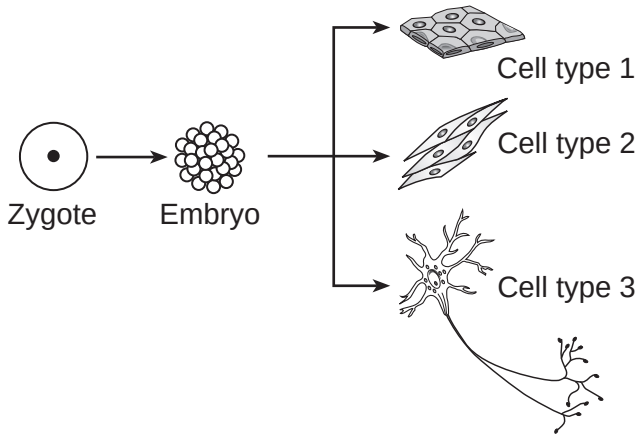
35 It has been widely accepted that humans inherit mitochondria from their mothers. DNA sequencing has recently provided evidence that children from several families with a history of mitochondrial disease have inherited mitochondria from their fathers. This discovery illustrates the concept that

(1) scientists in the past did not ask questions about the reliability of the source of data
(2) experiments without controls are valid if they obtain new information
(3) scientific explanations are tentative and subject to change as new discoveries are made
(4) claims should be questioned only when based on large samples of unbiased data

Base your answers to questions 36 and 37 on the diagram and chart below and on your knowledge of biology.

The diagram represents events that occur during the early stages of embryonic development. The chart shows some of the genes (*A*-*E*) present in each of the three cell types shown in the diagram.

The genes that are shaded in the chart represent genes that are expressed and used by that cell type.



Gene Expression

Cell Type 1	Cell Type 2	Cell Type 3
A	A	A
B	B	B
C	C	C
D	D	D
E	E	E

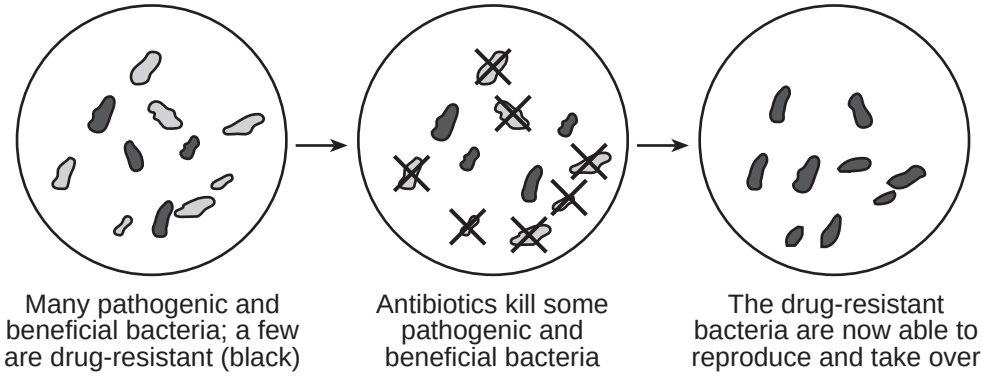
36 Different cell types can arise from genetically identical embryonic cells because

(1) different cells in the embryo contain completely different genes
(2) fertilization results in new gene combinations, which result in the different cell types
(3) mutations in embryonic cells result in new genes, resulting in the different cell types
(4) different cells have the same genes, but the same genes aren't expressed in all cells

37 A substance that is essential to the functioning of all cells is most likely coded for by gene

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

38 The diagram illustrates activities taking place with some bacteria.

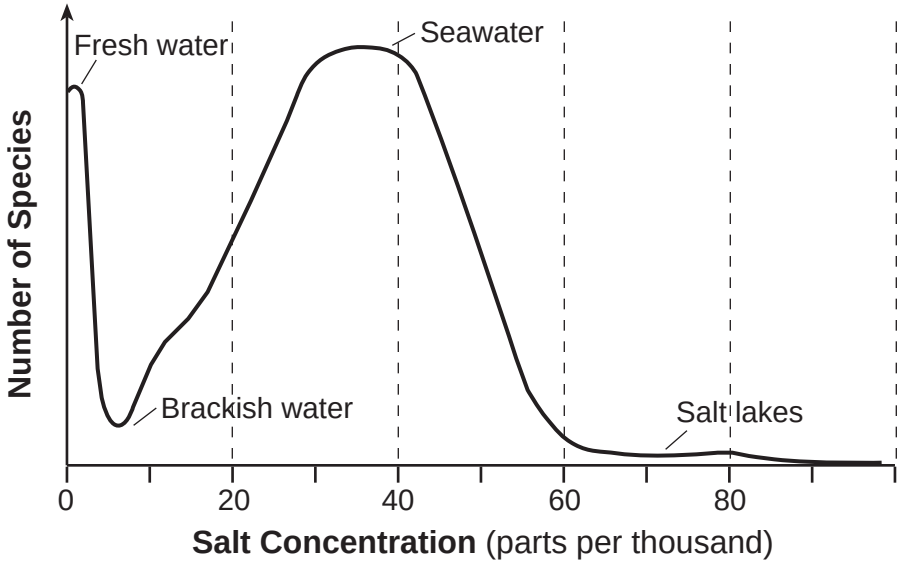


Source: Adapted from: http://www.cdc.gov

Individuals who contract a disease caused by a strain of a drug-resistant bacteria are at risk. This is because, when they are treated with certain antibiotics,

(1) the resistant bacteria survive in greater numbers and pass the trait to their offspring
(2) the beneficial bacteria are unaffected, rapidly reproduce, and destroy the resistant bacteria
(3) the resistant bacteria are killed only by increasing the dose of antibiotics
(4) the beneficial bacteria survive but do not pass their traits to their offspring

39 The graph below compares the number of species found in ecosystems with different salt concentrations.

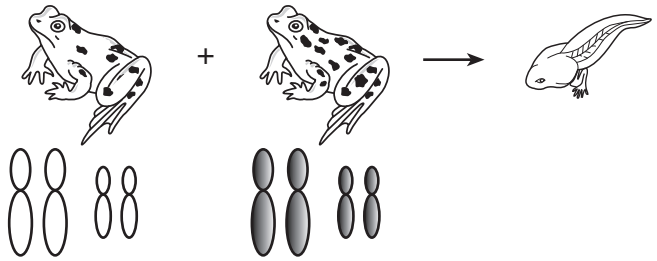


Source: https://www.estrellamountain.edu

Based on the data presented in the graph, which ecosystems are most likely to remain stable over time?

(1) fresh water and seawater because more species in an ecosystem increases the variety of genetic material available
(2) fresh water and seawater because an increased number of species causes salt concentration in the water to increase
(3) brackish water and seawater because high salt concentration increases the number of species in water ecosystems
(4) brackish water and salt lakes because salty water damages DNA, which results in fewer species surviving

40 The diagram below represents a male and female frog with a model of their chromosomes and their tadpole offspring.

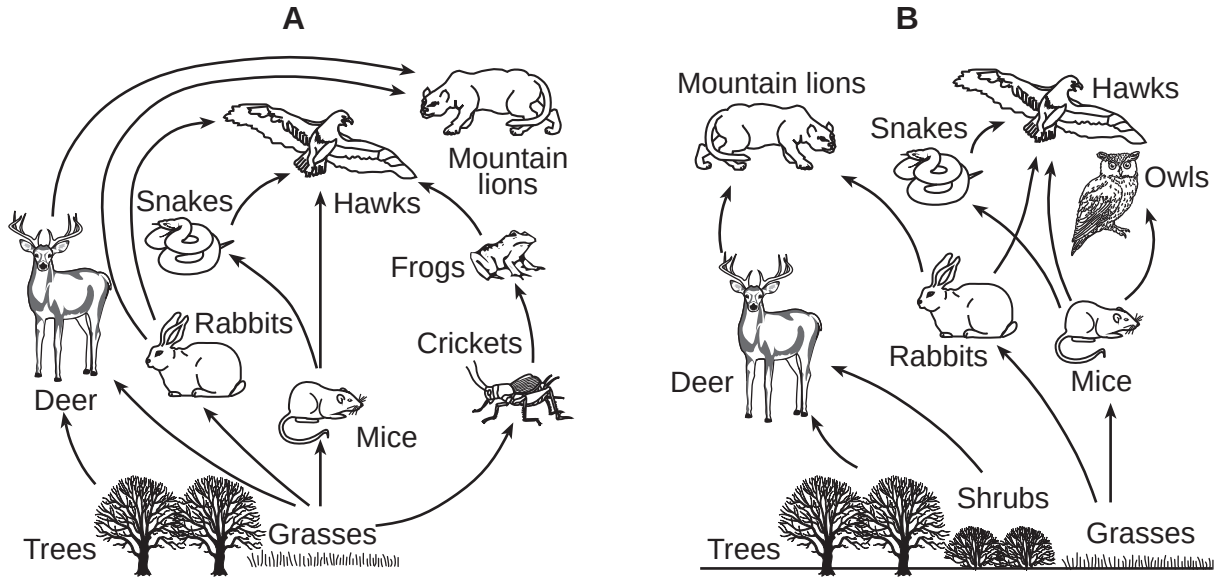


Source: www.kickstarter.com

Identify the pattern of chromosomes possible in the tadpole offspring from these parent frogs.

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

41 Food webs representing two nearby locations are shown below.

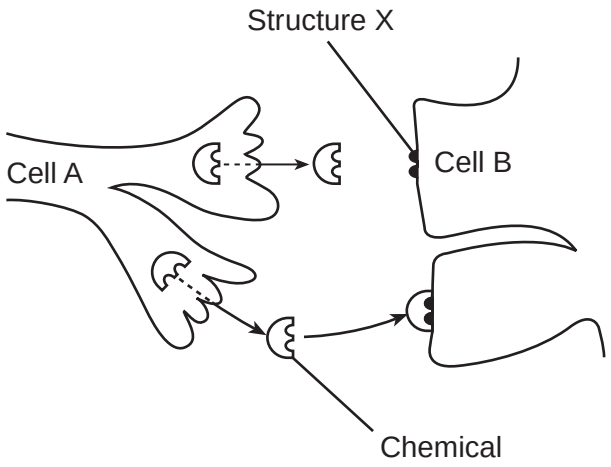


Source: https://www.kimberliejane.com

Which statement best describes what would most likely happen if some of the owls from location *B* moved to location *A*?

(1) The mountain lion population in location *B* will move to location *A*.
(2) The deer population in location *A* will decrease due to lack of resources.
(3) The hawk population in location *A* will decrease due to competition for food.
(4) The owl population in location *B* will increase due to a decrease in genetic variation.

42 Two human nerve cells are represented below.



The process represented in the diagram indicates that

(1) cell *A* is providing food to cell *B*
(2) a chemical from cell *B* is communicating with cell *A*
(3) cells *A* and *B* are attaching to each other
(4) cell *A* is communicating with cell *B*

43 Cellulose is the chemical name for the fiber found in fruits and vegetables. Cellulose is similar in structure to starch. It is most likely that humans can digest starch but *not* cellulose because

(1) cellulose molecules are too big to be absorbed into cells
(2) humans have enzymes to break down starch, but not cellulose
(3) humans have only starch-digesting ribosomes in their digestive system
(4) humans convert excess cellulose to glucose

Part B–2

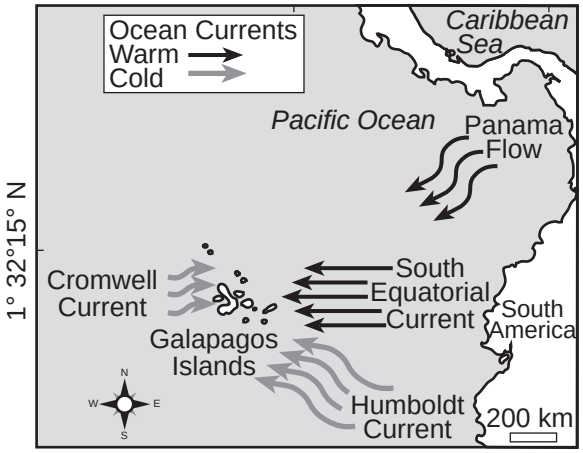
Answer all questions in this part. [12]

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 and data table below and on the next page, and on your knowledge of biology.

Galapagos Penguins

The Galapagos Islands, located just off the coast of Ecuador, are situated where the cool Humboldt current from the southeast, the warm Panama Flow current from the northeast, and the cold upwelling Cromwell current come together.



Source: Santiago-Alarcon, Diego & Merkel, Jane. (2018). New Host-Parasite Relationships by Host-Switching.

Source: J. Bartsch

The islands are home to a large number of unique animal and plant species. Darwin's finches are some of the most famous of the bird species. Another unique bird species is the Galapagos penguin. It is one of the smallest penguin species in the world. It is also the most northerly of all penguins. Their small population size and limited geographic range has resulted in them being classified as endangered.

In terms of diet, Galapagos penguins are generalists. They feed on animal life close to shore. They herd fish toward obstacles, such as rocks or boats, where they are trapped and easy to prey upon. The birds' ability to thrive at this tropical latitude is a result of ocean upwelling that results in cold water from the depths being pushed closer to the surface. The upwelling brings food from deeper in the ocean up to where various animal species can feed on it.

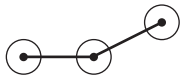
Some researchers claim that global climate change is increasing the ability of the Galapagos penguin to survive and reproduce. Others claim that decreases in the size of the Galapagos penguin population are directly related to warming temperatures. The sea surface temperature (SST) of the water surrounding the Galapagos Islands has been measured and is recorded in the data table.

Average Sea Surface Temperature (SST) of Ocean Surrounding the Galapagos Islands										
Year	1964	1966	1970	1972	1980	1982	1990	1994	1997	1998
Average SST (°C)	25.6	22.6	22.4	22.8	23.2	25.5	23.6	22.6	26.2	22.6

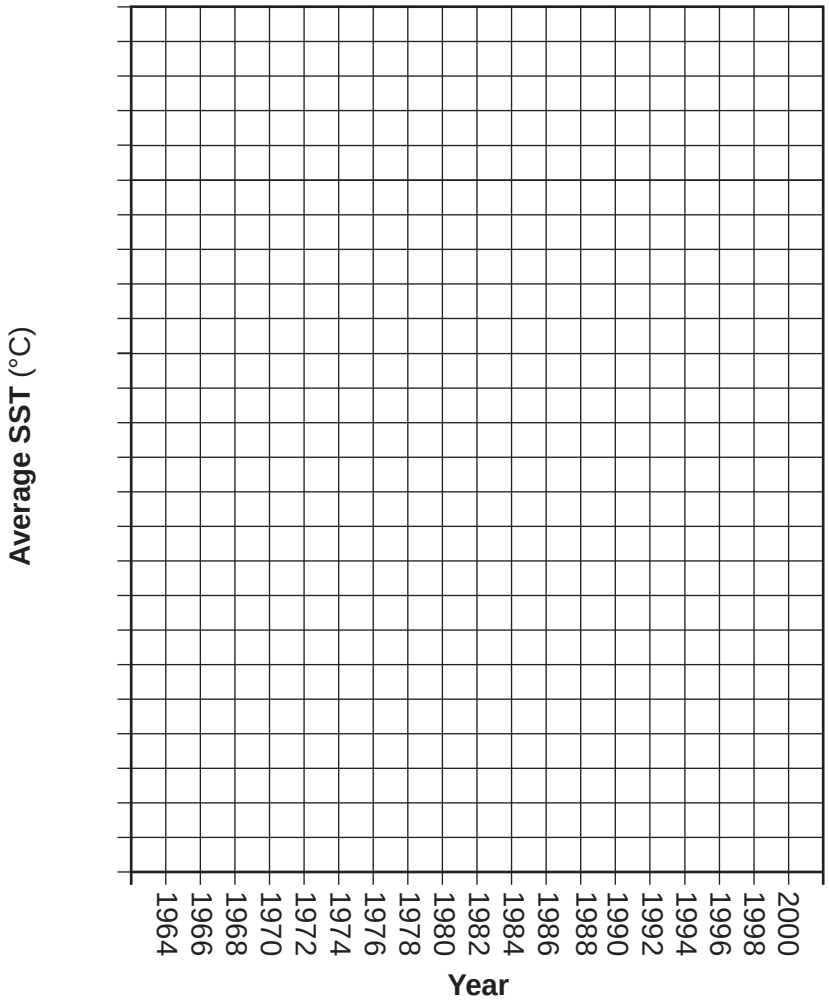
Directions (44–45): Using the information given, construct a line graph on the grid provided, following the instructions below.

44 Mark an appropriate scale, without any breaks in the data, on the axis labeled Average SST (°C). [1]

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

Example: 

Average Sea Surface Temperature (SST) of Ocean Surrounding the Galapagos Islands

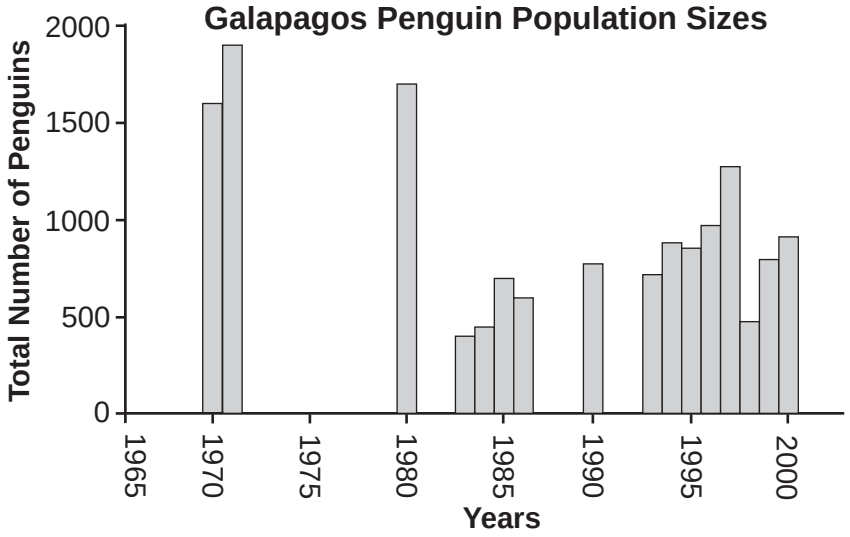


46 In addition to the surface water temperatures, what additional data could help explain the annual variation in the penguin population? Explain your reasoning. [1]

47 Ocean currents are associated with food availability for the Galapagos penguins. This is most likely due to the

(1) Panama Flow current carrying food from southern regions of the ocean to the Galapagos Islands
(2) Humboldt current bringing large amounts of algae from the southern ocean for the penguins to eat
(3) Cromwell current bringing food up to the surface from deeper in the ocean
(4) currents transporting the penguins to where the most food is located

The graph below provides information about Galapagos penguin population sizes.



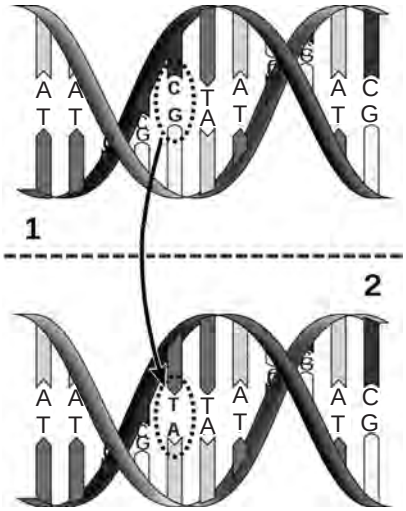
48 Using numeric data from the Galapagos Penguin Population Sizes graph, describe the overall trend in the size of the penguin population between 1970 and 2000. Support your answer with data from the graph. [1]

49 Of all penguin species, the Galapagos penguin lives in the warmest climate. Which statement describes a behavioral adaptation that would allow these penguins to be successful in their warm environment?

(1) Adult Galapagos penguins are about 19 inches tall and weigh about 5.5 pounds.
(2) These penguins lean forward to shade their feet from the Sun, and they stretch their flipper-like wings out to the sides. This helps them lose heat from the underparts of their wings and shades their feet.
(3) Female penguins lay two eggs directly on the lava flows.
(4) Galapagos penguin chicks develop special feathers: brown above with white underneath. This protects them from sunburn, rather than keeping them warm.

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

The diagram represents a segment of DNA in a body cell that has undergone a change in one of the molecular base pairs.



Source: Adapted from: http://rosalind.info/media/problems/hamm/point_mutation.png

50 What is a possible result of the change shown in the diagram?

(1) The number of chromosomes would decrease.
(2) The gene would move to another chromosome.
(3) A specific enzyme would no longer be made.
(4) More amino acids would be produced.

51 Would this change be present in the new body cells formed from this cell? Support your answer. [1]

Base your answer to question 52 on the information below and on your knowledge of biology.

Microplastics in the Environment

A scientific study discovered that small bits of plastic that are present in the environment are being ingested by mosquito larvae. These microplastics remain in their bodies throughout adulthood. Scientists are concerned that these microplastics could affect other animals, including humans.

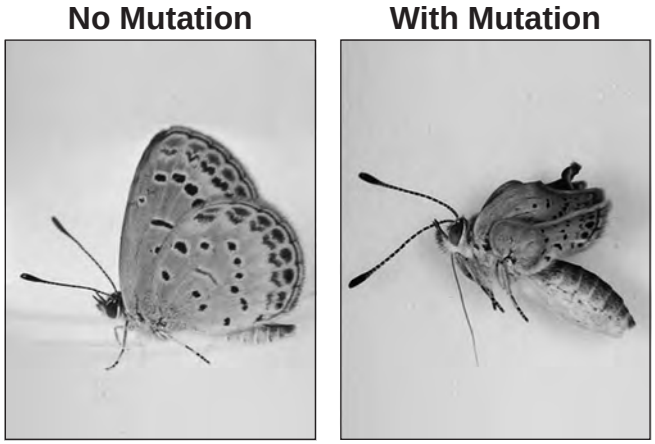
52 Describe how microplastics could be present in animals that do *not* normally eat mosquitoes. [1]

53 Explain why environmental factors have the greatest effect on an embryo during the early stages of pregnancy. [1]

Base your answer to question 54 on the information below and on your knowledge of biology.

Butterfly Mutations

A Japanese nuclear power plant was damaged by an earthquake and tsunami, causing it to leak radioactive materials. Pale grass blue butterflies near the damaged power plant have been found with mutations affecting their eyes and size of their wings.

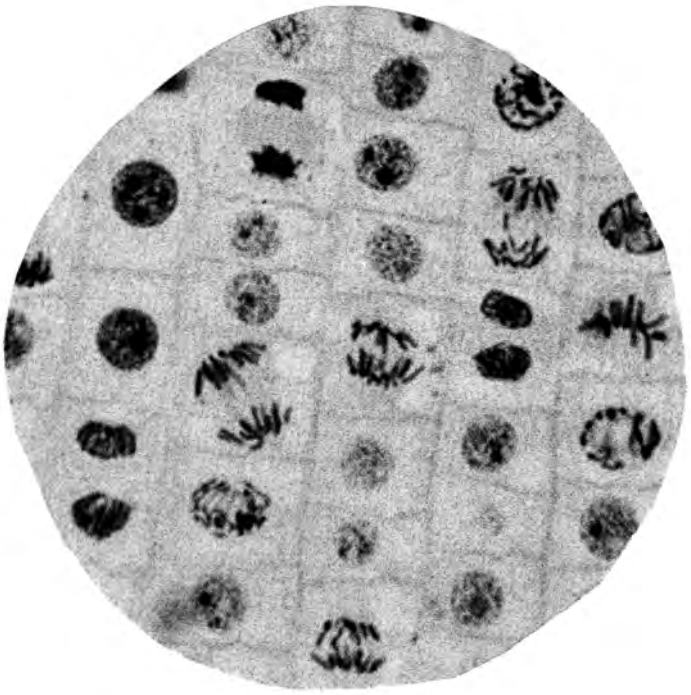


https://www.google.com/search?q=pale+grass+blue+butterfly

54 Identify a factor, other than nuclear radiation, that can cause a mutation. [1]

Base your answer to question 55 on the information and diagram below and on your knowledge of biology. The diagram represents a biological process.

A student made a wet mount slide of living onion root cells to observe with a microscope. The diagram below represents what the student saw.



Source: 2008 Pearson Education Inc., publishing as Pearson Benjamin Cummings

55 When cells divide, the chromosomes become visible. As the student studied this slide, she determined that some of the root cells were dividing. Support the student's claim by drawing a diagram in the box provided below of *one* specific cell on the slide where mitosis is clearly occurring. [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 59 on the passage below and on your knowledge of biology.

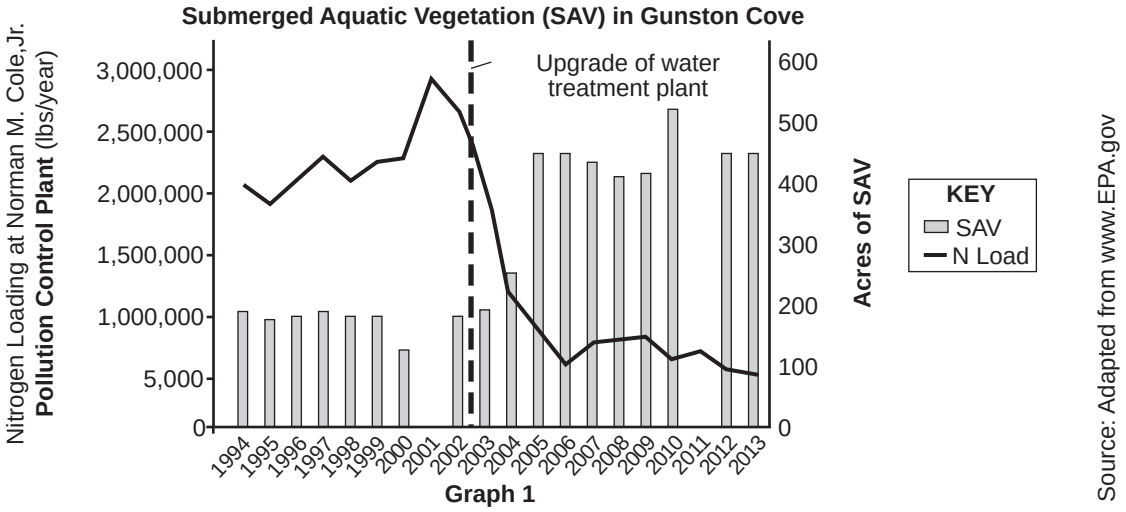
Plants Rebound in the Chesapeake Bay

Submerged aquatic vegetation (SAV), such as underwater grasses, in the Chesapeake Bay began to decrease in the 1950s as development began along the rivers that flowed into the bay. Runoff from home septic systems (sewage) and farms that use nitrogen fertilizers began to flow into the rivers that feed the bay. The wastes, containing both nitrogen and phosphorus, promoted algae growth, which blocked sunlight.

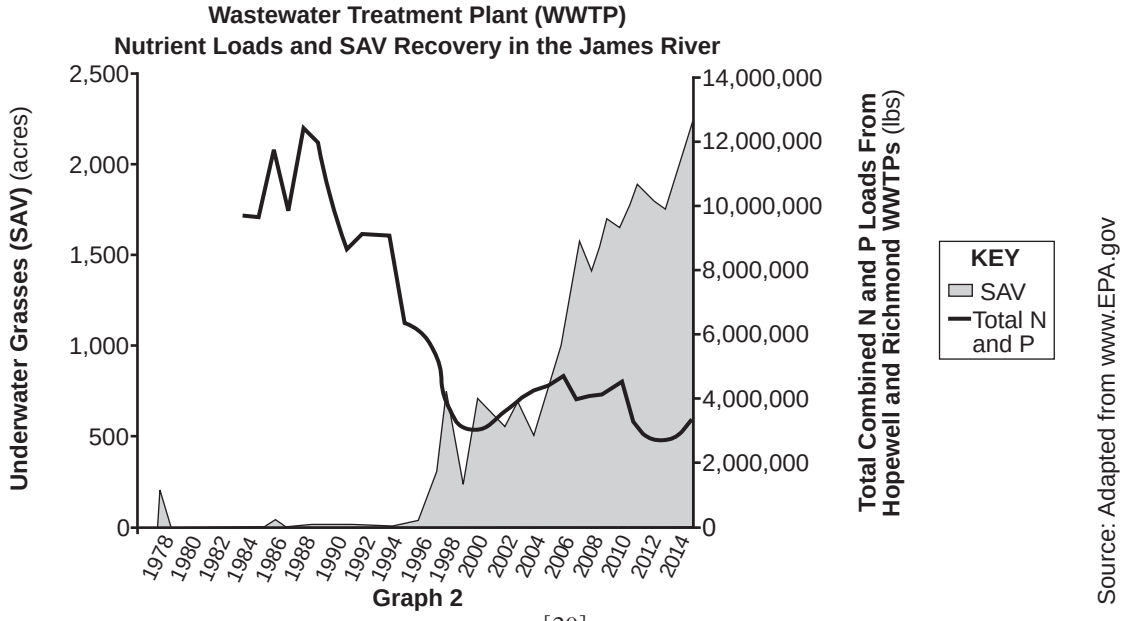
By 1972, there was no sea grass growing on the floor of the bay, and the quality of the water had decreased. The number of crabs and fish had also gone down.

Since 1985, as a result of the construction of wastewater treatment plants and other actions, the nitrogen and phosphorus levels have been reduced significantly, exceeding the initial goals set for 2025.

Some of the data collected from two locations within the Chesapeake Bay area are shown in the graphs below.



Graph 1



Graph 2

56 Using *one* specific example, describe how the development of areas along the rivers that ran into the Chesapeake Bay negatively affected the aquatic ecosystem of the bay. [1]

57 Identify *on*e abiotic factor that most likely contributed to the decrease in submerged aquatic vegetation (SAV) in the Chesapeake Bay. Support your answer by using evidence from the information given. [1]

58 Some ecologists claim that making continual improvements to the water treatment plants in the Chesapeake Bay area would be an effective way to continue to reduce or control water pollution. What evidence could be used to support this claim? [1]

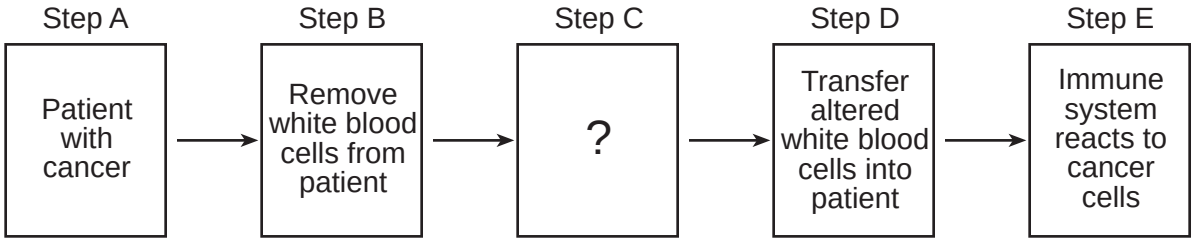
59 Other than the actions taken to improve the Chesapeake Bay ecosystem, describe *one* other action that people may take to solve another environmental problem. [1]

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

Anticancer Vaccines Become Personalized

Researchers are investigating a personalized approach to create an anticancer vaccine from a patient's own tumor cells. Some white blood cells are removed and grown with proteins unique to these cancer cells. The patient's white blood cells are changed by incorporating these proteins from the cancer cells. These altered blood cells can now work as a cancer vaccine. The cancer vaccine is transferred into the patient, and it stimulates the immune system to attack the cancer cells.

The diagram below represents a process that involves an anticancer vaccine.



60 Describe the specific process that is carried out at Step *C*. [1]

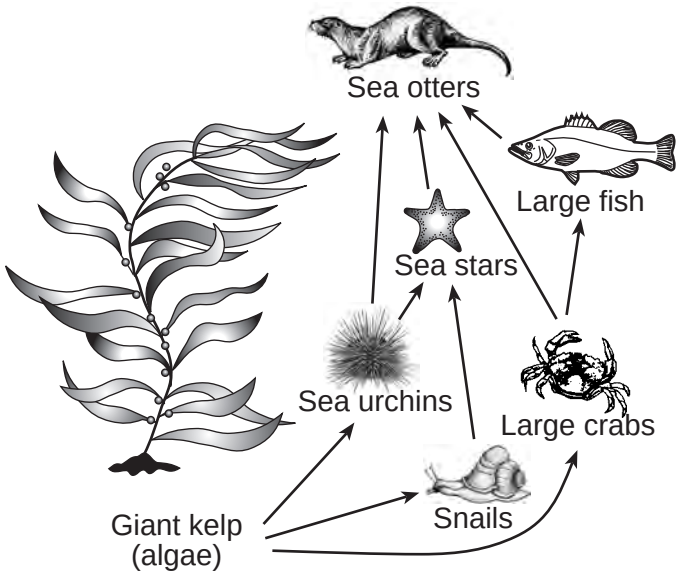
61 Describe *one* way that the stimulated immune system could react to the cancer cells in Step *E*. [1]

62 Explain how the use of a patient's own cells can reduce the risk of a *negative* response to the vaccine. [1]

63 The anticancer vaccine is different in that it is made with the patient's own cells. Explain *one* way that the content of the anticancer vaccine is similar to other vaccines. [1]

Base your answers to questions 64 and 65 on the information and diagram below and on your knowledge of biology.

The diagram represents some of the organisms found in an ocean food web in an area where giant kelp form "forests" of this fast-growing kind of algae.



Source: http://ircentral.airws.org

64 Explain why giant kelp is so essential to the stability of this food web. [1]

65 In some of the giant kelp forests off the coast of California, sea otters have disappeared in recent years. Explain why this change would be likely to have a large effect on the other organisms in this food web. [1]

Base your answer to question 66 on the information below and on your knowledge of biology.

To model a waste-disposal system, students placed organic food waste from the cafeteria into containers, covered them with mesh, and recorded their observations over a few weeks. They soon observed fungi growing on the waste. There was a decrease in the total mass of the food waste in the containers.

66 Identify the role of the fungi that grew on the food waste and explain its importance in a natural ecosystem. [1]

Base your answers to questions 67 through 70 on the information below and on your knowledge of biology.

Survival of the Sneakiest

It has long been thought that the evolutionary arms race is always won by the biggest or the most aggressive competitors. A closer look at nature reveals many instances in which the sneakiest is the winner.

For example, in the case of sunfish, most males are large and colorful and aggressively defend the territory in which they mate with females. However, there are some smaller and less colorful males in the population that mimic females in appearance. Since they resemble females, these males that mimic females are invited into the aggressive males' territory. While the big, colorful males are busy protecting their mating territory, these sneaky mimics swim right by them and fertilize the females' eggs.

On the island of Kauai, a similar scenario has played out. Crickets are a favorite meal for the larvae of a particular fly species, *Ormia ochracea*. Adult flies follow the mating calls of a chirping cricket and deposit their larvae on the cricket's back. The fly larvae burrow into the cricket, eventually killing it.

Some male crickets on the island are born silent, which helps protect them from attracting the flies, but they can't chirp to attract a mate. However, they can intercept and mate with the female crickets who are on their way to the chirping males.

67 Identify an event that most likely caused the first of these mimic sunfish to be smaller and less colorful. [1]

_____

68 Winning, in an evolutionary sense, is all about reproductive success. Explain why these sneaky mimic sunfish are reproductively successful. [1]

_____

_____

_____

69 Explain why being a silent male cricket would *not* be an advantage on an island that had no flies of the species *Ormia ochracea*. [1]

_____

_____

70 Describe how natural selection can explain the increase in the number of silent crickets on the island of Kauai. [1]

_____

_____

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

Antler Growth

As part of their natural life cycle, deer produce antlers every year. Scientists have noted that fallow deer antlers can grow to 50 inches in length and 20 pounds in weight in a single season. That would require the antlers to grow almost an inch per day in summer. Some of the processes involved in antler growth are similar to bone growth in humans. In fact, two genes in one species of deer that are primarily responsible for rapid antler growth are also found in humans.

Source: biologydictionary.net/fallow-deer/

71 Explain how it is possible that two organisms as different as humans and deer could have two identical genes. [1]

72 Describe how this research could benefit humans who are dealing with injuries to or diseases of the skeletal system. [1]

Part D

Answer all questions in this part. [13]

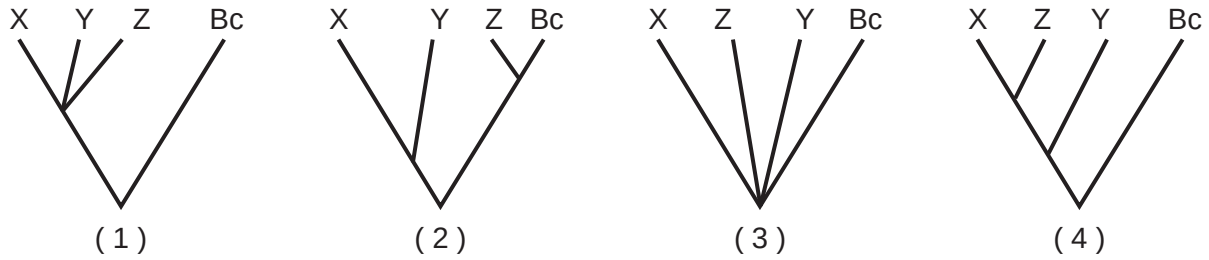
Directions (73–85): For those questions that are multiple choice, record on the separate answer sheet the *number* of the choice that, of those given, best completes each statement or answers each question. For all other questions in this part, follow the directions given and record your answers in the spaces provided in this examination booklet.

73 The finches of the Galapagos Islands likely came from a few birds that were able to fly there from Ecuador about two to three million years ago. Once the finches reached the islands, some

(1) quickly changed to fit the new environment of the islands
(2) outcompeted all other bird species native to the islands
(3) survived based on the adaptations that they had to the new environment
(4) mated with other bird species on the islands, resulting in birds better adapted to the new environment

74 The amino acid sequence of four species, *Bc*, *X*, *Y*, and *Z*, were compared to determine their evolutionary relationship. Based on the amino acid sequence below, identify the evolutionary tree that best represents the relationship between the species.

Species	Amino Acid Sequence
Bc	Val His Leu Thr Pro Glu Glu
X	Val His Leu Ser Pro Val Glu
Y	Val His Leu Ser Pro Val Glu
Z	Val His Leu Thr Pro Glu Glu



75 The gel electrophoresis patterns for two species can be compared to reveal similarities and differences in

(1) body structures
(2) base sequences
(3) gametes produced
(4) nutrients required

Base your answers to questions 76 and 77 on the information below and on your knowledge of biology.

Pulse Rates

A student heard a sports news report that several fans who were wearing smartwatches received irregular heart rate warnings as they were viewing the last few minutes of a football playoff game. The alert stated that they had an irregular increase in heart rate during a time in which they were inactive.

The student decided to conduct his own experiment in order to determine if watching an exciting sporting event would increase the pulse rates of viewers. He asked six of his friends to watch a championship game and had them take their pulse rates during the first quarter of the game and at the end of the game. The results are recorded in the data table below.

Pulse Rate (beats/min) **for Each Friend**

Friend	1	2	3	4	5	6
Pulse Rate First Quarter of Game	98	86	70	101	89	110
Pulse Rate End of Game	125	111	98	122	90	130

76 The dependent variable in this experiment is the

(1) number of friends participating
(2) times when the pulse rate was taken
(3) pulse rate of each person
(4) viewing of the sporting event

77 The student stated that data from his experiment supported his claim that pulse rate increases when watching an exciting sporting event. State an argument for why someone might *not* accept his claim. [1]

78 A sequence of mRNA bases that can produce a certain protein was found to be:

UUU GGG CCC AUA

Write the sequence of DNA that would produce this sequence of mRNA bases. [1]

79 State *one* laboratory procedure that would be used to make the organelles of onion cells on a wet mount slide more visible for viewing with a compound light microscope. [1]

80 Over many years, one particular species of finch has been studied on one of the Galapagos Islands. A family tree representing many generations has been constructed. It includes every bird of that species. Some family groups (branches of the tree) produced offspring that survived and other family groups did not. Provide *one* possible reason why some family groups did not survive. [1]

_____

_____

81 The differing rates of migration of DNA fragments in a gel electrophoresis procedure is mainly due to

(1) the volume of the DNA sample used
(2) the size of the DNA fragments produced
(3) the number of DNA fragments in the gel
(4) the size of the wells of the gel

82 Which part of the *Beaks of Finches* lab activity was changed in order to simulate the different conditions on various islands?

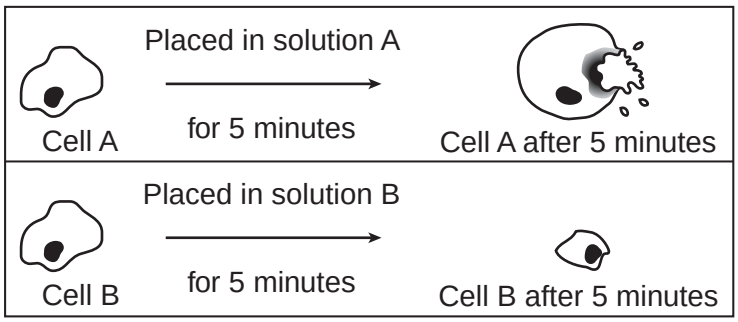
(1) type of beak
(2) size of beak
(3) type of seeds present
(4) size of stomach container

83 Explain how the *Beaks of Finches* laboratory activity demonstrated the concept of competition. [1]

_____

_____

84 Two skin cells from the same animal were each placed in a different solution. The diagrams below represent the changes that occurred in each cell after 5 minutes in each solution.



Which cell was placed in a solution containing a higher concentration of salt than the concentration of salt normally found in these skin cells? Support your answer. [1]

85 After an experimental study, during the peer review process, it was suggested that the experiment should be replicated. Explain why there is a need to replicate experiments and studies before conclusions are accepted by the scientific community. [1]

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LIVING ENVIRONMENT

The State Education Department / The University of the State of New York

Regents Examination in Living Environment – August 2023

Scoring Key: Parts A, B-1, B-2 and D (Multiple-Choice Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Living Environment	August '23	**1**	**1**	MC	1	1
Living Environment	August '23	**2**	**4**	MC	1	1
Living Environment	August '23	**3**	**3**	MC	1	1
Living Environment	August '23	**4**	**3**	MC	1	1
Living Environment	August '23	**5**	**2**	MC	1	1
Living Environment	August '23	**6**	**4**	MC	1	1
Living Environment	August '23	**7**	**4**	MC	1	1
Living Environment	August '23	**8**	**1**	MC	1	1
Living Environment	August '23	**9**	**1**	MC	1	1
Living Environment	August '23	**10**	**4**	MC	1	1
Living Environment	August '23	**11**	**2**	MC	1	1
Living Environment	August '23	**12**	**4**	MC	1	1
Living Environment	August '23	**13**	**3**	MC	1	1
Living Environment	August '23	**14**	**1**	MC	1	1
Living Environment	August '23	**15**	**2**	MC	1	1
Living Environment	August '23	**16**	**4**	MC	1	1
Living Environment	August '23	**17**	**3**	MC	1	1
Living Environment	August '23	**18**	**1**	MC	1	1
Living Environment	August '23	**19**	**4**	MC	1	1
Living Environment	August '23	**20**	**2**	MC	1	1
Living Environment	August '23	**21**	**2**	MC	1	1
Living Environment	August '23	**22**	**1**	MC	1	1
Living Environment	August '23	**23**	**2**	MC	1	1
Living Environment	August '23	**24**	**2**	MC	1	1
Living Environment	August '23	**25**	**1**	MC	1	1
Living Environment	August '23	**26**	**4**	MC	1	1
Living Environment	August '23	**27**	**2**	MC	1	1
Living Environment	August '23	**28**	**3**	MC	1	1
Living Environment	August '23	**29**	**1**	MC	1	1
Living Environment	August '23	**30**	**3**	MC	1	1
Living Environment	August '23	**31**	**1**	MC	1	1
Living Environment	August '23	**32**	**4**	MC	1	1
Living Environment	August '23	**33**	**4**	MC	1	1
Living Environment	August '23	**34**	**1**	MC	1	1
Living Environment	August '23	**35**	**3**	MC	1	1
Living Environment	August '23	**36**	**4**	MC	1	1
Living Environment	August '23	**37**	**1**	MC	1	1
Living Environment	August '23	**38**	**1**	MC	1	1
Living Environment	August '23	**39**	**1**	MC	1	1
Living Environment	August '23	**40**	**2**	MC	1	1
Living Environment	August '23	**41**	**3**	MC	1	1
Living Environment	August '23	**42**	**4**	MC	1	1
Living Environment	August '23	**43**	**2**	MC	1	1
Living Environment	August '23	**47**	**3**	MC	1	1
Living Environment	August '23	**49**	**2**	MC	1	1
Living Environment	August '23	**50**	**3**	MC	1	1
Living Environment	August '23	**73**	**3**	MC	1	1
Living Environment	August '23	**74**	**2**	MC	1	1
Living Environment	August '23	**75**	**2**	MC	1	1
Living Environment	August '23	**76**	**3**	MC	1	1
Living Environment	August '23	**81**	**2**	MC	1	1
Living Environment	August '23	**82**	**3**	MC	1	1

Regents Examination in Living Environment – August 2023

Scoring Key: Parts B-2, C, and D (Constructed Response Questions)

Examination	Date	Question Number	Scoring Key	Question Type	Credit	Weight
Living Environment	August '23	**44**	–	CR	1	1
Living Environment	August '23	**45**	–	CR	1	1
Living Environment	August '23	**46**	–	CR	1	1
Living Environment	August '23	**48**	–	CR	1	1
Living Environment	August '23	**51**	–	CR	1	1
Living Environment	August '23	**52**	–	CR	1	1
Living Environment	August '23	**53**	–	CR	1	1
Living Environment	August '23	**54**	–	CR	1	1
Living Environment	August '23	**55**	–	CR	1	1
Living Environment	August '23	**56**	–	CR	1	1
Living Environment	August '23	**57**	–	CR	1	1
Living Environment	August '23	**58**	–	CR	1	1
Living Environment	August '23	**59**	–	CR	1	1
Living Environment	August '23	**60**	–	CR	1	1
Living Environment	August '23	**61**	–	CR	1	1
Living Environment	August '23	**62**	–	CR	1	1
Living Environment	August '23	**63**	–	CR	1	1
Living Environment	August '23	**64**	–	CR	1	1
Living Environment	August '23	**65**	–	CR	1	1
Living Environment	August '23	**66**	–	CR	1	1
Living Environment	August '23	**67**	–	CR	1	1
Living Environment	August '23	**68**	–	CR	1	1
Living Environment	August '23	**69**	–	CR	1	1
Living Environment	August '23	**70**	–	CR	1	1
Living Environment	August '23	**71**	–	CR	1	1
Living Environment	August '23	**72**	–	CR	1	1
Living Environment	August '23	**77**	–	CR	1	1
Living Environment	August '23	**78**	–	CR	1	1
Living Environment	August '23	**79**	–	CR	1	1
Living Environment	August '23	**80**	–	CR	1	1
Living Environment	August '23	**83**	–	CR	1	1
Living Environment	August '23	**84**	–	CR	1	1
Living Environment	August '23	**85**	–	CR	1	1

Key
MC = Multiple-choice question
CR = Constructed-response question

The chart for determining students' final examination scores for the **August 2023 Regents Examination in Living Environment** will be posted on the Department's web site at https://www.nysedregents.org/LivingEnvironment/ on the day of the examination. Conversion charts provided for the previous administrations of the Living Environment examination must NOT be used to determine students' final scores for this administration.

FOR TEACHERS ONLY

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

LIVING ENVIRONMENT

Thursday, August 17, 2023 — 12:30 to 3:30 p.m., only

RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 2 before rating student papers.

Updated information regarding the rating of this examination may be posted on the New York State Education Department's web site during the rating period. Check this web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations and select the link "Scoring Information" for any recently posted information regarding this examination. This site should be checked before the rating process for this examination begins and several times throughout the Regents Examination period.

Directions to the Teacher

Follow the procedures below for scoring student answer papers for the Regents Examination in Living Environment. Additional information about scoring is provided in the publication *Information Booklet for Scoring Regents Examinations in the Sciences*.

Allow 1 credit for a correct response to each item.

At least two science teachers must participate in the scoring of the Part B–2, Part C, and Part D open-ended questions on a student's paper. Each of these teachers should be responsible for scoring a selected number of the open-ended questions on each answer paper. No one teacher is to score more than approximately one-half of the open-ended questions on a student's answer paper. Teachers may not score their own students' answer papers.

Students' responses must be scored strictly according to the Rating Guide. For open-ended questions, credit may be allowed for responses other than those given in the rating guide if the response is a scientifically accurate answer to the question and demonstrates adequate knowledge as indicated by the examples in the rating guide. Do not attempt to correct the student's work by making insertions or changes of any kind. On the student's separate answer sheet, for each question, record the number of credits earned and the teacher's assigned rater/scorer letter.

Fractional credit is *not* allowed. Only whole-number credit may be given for a response. If the student gives more than one answer to a question, only the first answer should be rated. Units need not be given when the wording of the questions allows such omissions.

For hand scoring, raters should enter the scores earned in the appropriate boxes printed on the separate answer sheet. Next, the rater should add these scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score should be converted to a scale score by using the conversion chart that will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations on Thursday, August 17, 2023. The student's scale score should be entered in the box labeled "Scale Score" on the student's answer sheet. The scale score is the student's final examination score.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart may change from one administration to another, it is crucial that, for each administration, the conversion chart provided for that administration be used to determine the student's final score.

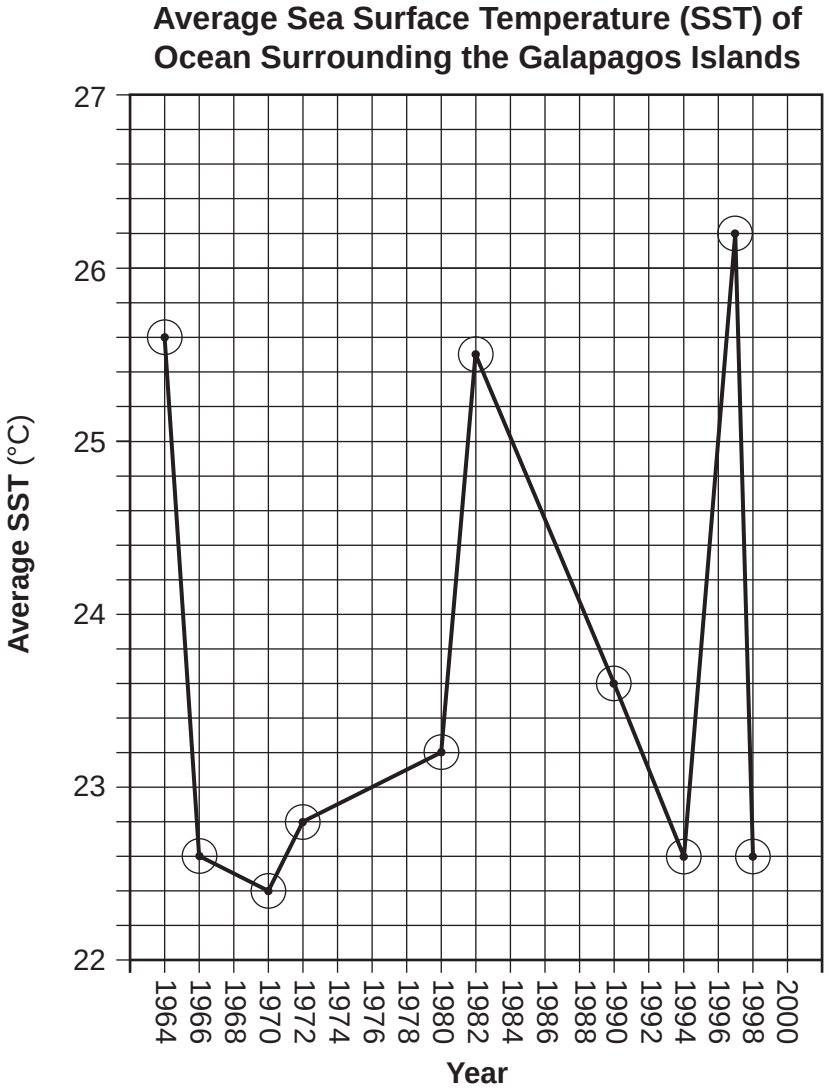
Part B–2

44 [1] Allow 1 credit for marking an appropriate scale, without any breaks in the data, on the axis labeled Average SST (°C).

Note: Do *not* allow credit if the grid is extended to accommodate the scale.

45 [1] Allow 1 credit for correctly plotting the data, connecting the points, and surrounding each point with a small circle.

Example of a 2-credit graph for questions 44-45:



Note: Allow credit if the points are plotted correctly, but not circled.

Do *not* assume that the intersection of the *x*- and *y*-axes is the origin (0,0) unless it is labeled. An appropriate scale only needs to include the data range in the data table.

Do *not* allow credit if points are plotted that are not in the data table, e.g., (0,0), or for extending lines beyond the data points.

46 [1] Allow 1 credit for what additional data could help explain the annual variation in the penguin population and explaining the reasoning.

Number of predators

— Predators would reduce the population.

Timing of storms

— Storms during egg-laying could destroy eggs.

Available food

— Penguins need a constant supply of food.

47 MC on scoring key

48 [1] Allow 1 credit for describing the overall trend in the size of the penguin population between 1970 and 2000 and supporting the answer with numeric data from the graph. Acceptable responses include, but are not limited to:

— The population size has decreased between 1970 and 2000. In 1970 and 1971, the size of the population was about 1600 and 1800. The population was never that large again.

— The population decreased from a high of about 1800 in 1971 to about 900 in 2000.

— The primary trend was that the overall size of the population decreased from 1800 to 900 penguins.

49 MC on scoring key

50 MC on scoring key

51 [1] Allow 1 credit for indicating that the change would be present and supporting the answer. Acceptable responses include, but are not limited to:

— Yes, because body cells produce new cells by copying the DNA, so the change would be in the new cells.

— Yes, because the cells go through mitosis/mitotic cell division.

— Yes, because the altered gene (DNA) can be passed on to every cell that develops from it.

52 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Predators of mosquitoes are eaten by other predators. The microplastics in their bodies are then passed to other organisms in the food chain.

— Any organisms that eat other prey with microplastics in them will have microplastics in their bodies.

— When the mosquitoes bite, they might inject the microplastics along with their saliva.

— If microplastics are in the environment, other organisms can ingest them from water or soil.

53 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Essential organs/tissues are forming at that time.

— Organ development occurs in early stages of pregnancy.

54 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— UV radiation/light

— sunlight

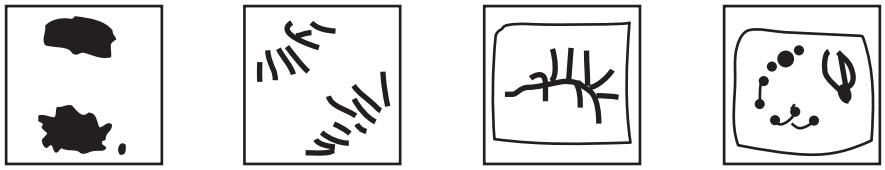
— certain chemicals

— cigarette smoke

— error in DNA replication

Note: Do *not* allow credit for just "radiation" without indicating a type.

55 [1] Allow 1 credit. Acceptable responses include, but are not limited to:



Part C

56 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Fertilizer from farms and sewage from homes caused the algae to grow, blocking sunlight for sea grasses. This caused a decrease in plants, and photosynthesis was greatly reduced.

— As development took place, nitrogen buildup caused an increase in algae, which blocked sunlight, reducing photosynthesis.

— An increase in water pollution caused sea grasses and plants to die, and there was less food available in the ecosystem.

57 [1] Allow 1 credit for identifying *one* abiotic factor that most likely contributed to the decrease in submerged aquatic vegetation (SAV) in the Chesapeake Bay and supporting the answer. Acceptable responses include, but are not limited to:

— Graph 1 shows that from 1994 to 2003, the nitrogen level in the bay was high and the amount of vegetation was low.

— The presence of nitrogen in the bay kept the amount of bottom vegetation low from 1994 to 2002 because it promoted algae growth on the surface.

— Graph 2 shows that, when nitrogen/phosphorus levels were high from 1978 to 1994, there was very little vegetation in the bay.

— The wastes containing nitrogen and fertilizer promoted algae growth, which blocked sunlight.

58 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Since nitrogen and phosphorus levels have been reduced through water treatment, as shown in graph 2, continued improvements in water treatment should continue to reduce the nitrogen and phosphorus levels.

— Since the goals set for 2025 for water improvement have been reached and passed, continued improvements in water treatment should remove more pollutants and continue to keep the water clean.

— The graphs show that the use of the water treatment plants has improved the water quality by reducing the amounts of phosphorus and nitrogen in the bay.

— The use of upgraded water treatment plants resulted in decreased nitrogen/phosphorus and an increase in SAV, as shown in the graphs.

59 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Protect endangered animals to preserve biodiversity in ecosystems.

— Decrease air pollution to reduce the effect of acid rain in rivers and lakes, which helps local wildlife.

— Pass laws to reduce air pollution issues.

— Pass laws to limit the killing of endangered animals.

— Demonstrations/marches could be held to encourage solving environmental problems such as climate change.

60 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Change the patient's blood cells by incorporating proteins unique to these cancer cells.

— Alter white blood cells by adding cancer cell proteins.

— White blood cells are grown with proteins from cancer cells.

— Genetic engineering could alter white blood cells to produce cancer proteins.

61 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Some white blood cells could engulf the cancer cells.

— Cells could produce antibodies that attack the cancer cells.

— Cells could be produced that remain and fight off cancer cells in the future.

— The immune system could attack the cancer cells.

62 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Since the vaccine is made from the patient's cells, the immune system won't treat them as foreign.

— Most of the components of the cancer vaccine are common to the patient.

— The proteins in the vaccine, other then those unique to cancer cells, are already in the patient's cells, so the patient shouldn't have a negative reaction.

63 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Both vaccines contain proteins/antigens that stimulate the immune system.

— Both contain proteins/RNA that prepare the body to fight harmful cells.

— Both contain antigens.

64 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— These algae use energy from the Sun to make food, which provides energy for the other organisms in the food web.

— Autotrophs make food by using sunlight (photosynthesis). Without this food, other organisms would not have a source of energy to keep them alive.

— In this food web, the kelp provide the food that supplies energy/matter directly or indirectly to other organisms in the food web. Without this, none of the other organisms could survive.

— They produce oxygen needed for respiration.

— They convert light energy into the chemical energy of food.

65 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The sea otters feed on many of the organisms in this food web. Without them, the other populations could increase and disrupt the entire web.

— The sea otters keep the sea urchins under control. Without the otters, the sea stars may not be able to keep the urchins from increasing significantly, so much of the kelp may be eaten and the entire ecosystem could be destroyed.

— The only remaining control of the sea urchins would fall to the sea stars, but if the urchin population grows too quickly, they could destroy all of the kelp and the food web could be totally disrupted.

66 [1] Allow 1 credit for decomposer and explaining its importance in an ecosystem. Acceptable responses include, but are not limited to:

— Molecules are broken down by decomposers. This process provides plants with nutrients.

— Fungi are decomposers that recycle nutrients.

67 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— A mutation could have resulted in a smaller, less colorful sunfish.

— sexual reproduction that led to new traits

— the recombination of genes from sexual reproduction

— a mutation

68 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— They trick the other males into thinking that they are female, so they can sneak by and fertilize the eggs, thereby passing on their genes.

— The mimics fertilize the eggs before the colorful, aggressive males can fertilize them.

— They increase the number of offspring that carry their genes.

69 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— A silent cricket wouldn't be able to attract mates, since it can't chirp a mating call.

— If there are no flies for the crickets to avoid, there is no advantage to being silent.

— Without predators or parasites, there is no selection against chirping.

70 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The number of silent crickets will increase because they can avoid an attack by the flies and reproduce. More silent crickets would be produced. The chirping crickets would slowly die off.

— Silent crickets can avoid a predator attack, so they are more likely to survive, reproduce, and pass on this advantageous trait.

71 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Deer and humans are both mammals and share many genes in common due to common ancestry.

— In the distant past, humans and deer probably shared a common ancestor.

72 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Growing antlers is similar to human bone growth, so the rapid growth of the antlers could give scientists ways to speed up healing in humans who have broken bones.

— Healing broken bones takes a lot of time. Scientists could learn from the processes that antler growth uses to help repair bones injured through disease.

— Understanding how these antlers grow so rapidly could provide scientists with ways to speed up human bone repair.

Part D

73 MC on scoring key

74 MC on scoring key

75 MC on scoring key

76 MC on scoring key

77 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— The claim may not be accepted because the student did not take pulse rates before the game started.

— The claim would not be accepted because the student used a small sample size of only six individuals.

— The claim would not be accepted because the student didn't repeat his experiment, in order to have a larger sample tested.

— Not all the friends showed a large difference in heart rate.

— All variables were not controlled.

78 [1] Allow 1 credit for AAA CCC GGG TAT.

79 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— add stain to the slide

— adjust the light

— adjust the focus

— clean the lenses

80 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Some groups lacked traits that would have made them better adapted.

— Some were unsuccessful at getting food for their young.

— Some groups were not able to escape predators successfully.

— Some had beaks that could not break open the kinds of seeds available.

— Some died from disease.

81 MC on scoring key

82 MC on scoring key

83 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Competition for food occurred when the seeds became scarce, as in the second round.

— Several students competed when they tried to get food/seeds out of a small dish.

84 [1] Allow 1 credit for *B* and supporting the answer. Acceptable responses include, but are not limited to:

— When cells are placed in a high salt concentration solution, they lose water and shrink.

— When the skin cells are placed in a high salt concentration, water will leave the cell and go into an area with less water concentration, so the skin cell shrinks.

— because cell *B* shrank

— because plasmolysis took place

85 [1] Allow 1 credit. Acceptable responses include, but are not limited to:

— Experiments/studies need to be replicated because this process can verify that appropriate experimental procedures were used.

— It will further verify that the conclusion is correct.

— Scientists need to obtain data to further support the conclusion.

— Multiple trials provide additional data for reaching a more valid conclusion.

Regents Examination in Living Environment

August 2023

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

The *Chart for Determining the Final Examination Score for the August 2023 Regents Examination in Living Environment* will be posted on the Department's web site at: https://www.nysed.gov/state-assessment/high-school-regents-examinations on Thursday, August 17, 2023. Conversion charts provided for previous administrations of the Regents Examination in Living Environment must NOT be used to determine students' final scores for this administration.

Online Submission of Teacher Evaluations of the Test to the Department

Suggestions and feedback from teachers provide an important contribution to the test development process. The Department provides an online evaluation form for State assessments. It contains spaces for teachers to respond to several specific questions and to make suggestions. Instructions for completing the evaluation form are as follows:

1. Go to https://www.nysed.gov/state-assessment/teacher-feedback-state-assessments.

2. Select the test title.

3. Complete the required demographic fields.

4. Complete each evaluation question and provide comments in the space provided.

5. Click the SUBMIT button at the bottom of the page to submit the completed form.

Map to Core Curriculum

August 2023 Living Environment

Standards	Question Numbers			
	Part A 1–30	**Part B–1 31–43**	**Part B–2 44–55**	**Part C 56–72**
Standard 1 — Analysis, Inquiry and Design				
Key Idea 1		32, 35, 38	48	60
Key Idea 2				
Key Idea 3		33, 37		58
Appendix A (Laboratory Checklist)			44, 45, 55	
Standard 4				
Key Idea 1	1, 5, 8, 11, 13	41, 42, 43		64, 65, 66
Key Idea 2	7, 9, 10, 19, 21	36	50, 51	
Key Idea 3			49, 54	67, 68, 69, 70, 71
Key Idea 4	12, 18, 23, 28	40	53	
Key Idea 5	3, 4, 6, 15, 22, 26, 27			61, 62, 63, 72
Key Idea 6	2, 16, 17, 24	31, 39	46, 47	57
Key Idea 7	14, 20, 25, 29, 30	34	52	56, 59

Part D 73–85	
Lab 1	74, 75, 78, 81
Lab 2	76, 77, 85
Lab 3	73, 80, 82, 83
Lab 5	79, 84

The State Education Department / The University of the State of New York

Regents Examination in Living Environment – August 2023

Chart for Converting Total Test Raw Scores to Final Examination Scores (Scale Scores)

Raw Score	Scale Score
85	**100**
84	**98**
83	**97**
82	**96**
81	**95**
80	**95**
79	**94**
78	**93**
77	**92**
76	**92**
75	**91**
74	**90**
73	**89**
72	**89**
71	**88**
70	**87**
69	**86**
68	**86**
67	**85**
66	**84**
65	**84**
64	**83**
63	**82**
62	**82**
61	**81**
60	**80**
59	**80**
58	**79**
57	**78**

Raw Score	Scale Score
56	**77**
55	**77**
54	**76**
53	**75**
52	**75**
51	**74**
50	**73**
49	**72**
48	**72**
47	**71**
46	**70**
45	**69**
44	**68**
43	**67**
42	**66**
41	**65**
40	**64**
39	**63**
38	**62**
37	**61**
36	**60**
35	**59**
34	**58**
33	**57**
32	**56**
31	**55**
30	**53**
29	**52**
28	**51**

Raw Score	Scale Score
27	**49**
26	**48**
25	**47**
24	**45**
23	**44**
22	**42**
21	**41**
20	**39**
19	**38**
18	**36**
17	**35**
16	**33**
15	**31**
14	**29**
13	**28**
12	**26**
11	**24**
10	**22**
9	**20**
8	**18**
7	**16**
6	**14**
5	**12**
4	**10**
3	**7**
2	**5**
1	**2**
0	**0**

To determine the student's final examination score, find the student's total test raw score in the column labeled "Raw Score" and then locate the scale score that corresponds to that raw score. The scale score is the student's final examination score. Enter this score in the space labeled "Scale Score" on the student's answer sheet.

Schools are not permitted to rescore any of the open-ended questions on this exam after each question has been rated once, regardless of the final exam score. Schools are required to ensure that the raw scores have been added correctly and that the resulting scale score has been determined accurately.

Because scale scores corresponding to raw scores in the conversion chart change from one administration to another, it is crucial that for each administration the conversion chart provided for that administration be used to determine the student's final score. The chart above is usable only for this administration of the Regents Examination in Living Environment.