The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Wednesday, August 13, 2003 — 12:30 to 3:30 p.m., only

Student Name _____

School Name _____

Print your name and the name of your school on the lines above. Then turn to the last page of this booklet, which is the answer sheet for Part A. Fold the last page along the perforations and, slowly and carefully, tear off the answer sheet. Then fill in the heading of your answer sheet.

This examination has three parts. You must answer all questions in this examination. Write your answers to the Part A multiple-choice questions on the separate answer sheet. Write your answers for the questions in Parts B and C directly in this examination booklet. All answers 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 and in this examination booklet.

When you have completed the examination, you must sign the statement printed on the Part A 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.

DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part A

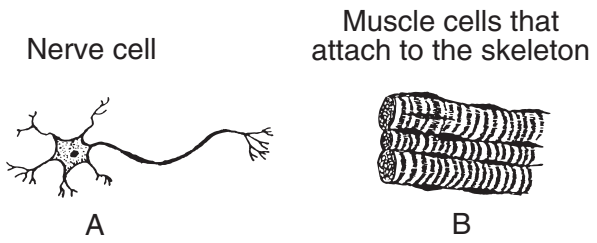
Answer all questions in this part. [35]

Directions (1–35): For *each* statement or question, write 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 The pancreas produces one hormone that lowers blood sugar level and another that increases blood sugar level. The interaction of these two hormones most directly helps humans to

(1) maintain a balanced internal environment
(2) digest needed substances for other body organs
(3) dispose of wastes formed in other body organs
(4) increase the rate of cellular communication

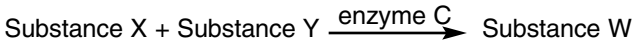
2 Two types of human cells are shown in the diagram below.



Cell *A* causes the cells at *B* to contract. This activity would be most useful for

(1) lifting a book from a bookshelf
(2) coordinating the functions of organelles
(3) digesting food in the small intestine
(4) carrying out the process of protein synthesis

3 The equation below represents a chemical reaction that occurs in humans.



What data should be collected to support the hypothesis that enzyme *C* works best in an environment that is slightly basic?

(1) the amino acid sequence of enzyme *C*
(2) the amount of substance *W* produced in five minutes at various pH levels
(3) the shapes of substances *X* and *Y* after the reaction occurs
(4) the temperature before the reaction occurs

4 A student hypothesized that lettuce seeds would not sprout (germinate) unless they were exposed to darkness. The student planted 10 lettuce seeds under a layer of soil and scattered 10 lettuce seeds on top of the soil. The data collected are shown in the table below.

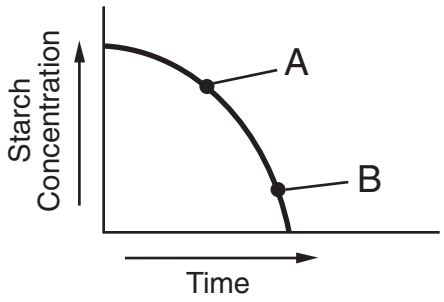
Data Table

Seed Treatment	Number of Seeds Germinated
Planted under soil	9
Scattered on top of soil	8

One way to improve the validity of these results would be to

(1) conclude that darkness is necessary for lettuce seed germination
(2) conclude that light is necessary for lettuce seed germination
(3) revise the hypothesis
(4) repeat the experiment

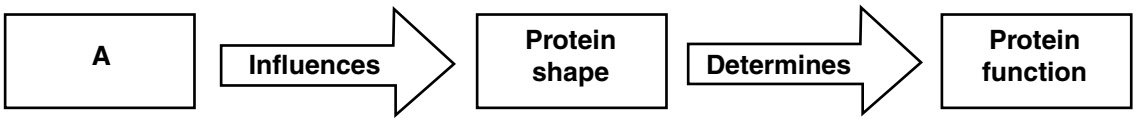
5 The graph below represents data obtained from an experiment on starch digestion.



Which statement best describes point *A* and point *B* on the graph?

(1) The concentration of sugars is greater at point *A* than it is at point *B*.
(2) The concentration of sugars is greater at point *B* than it is at point *A*.
(3) The starch concentration is the same at point *A* as it is at point *B*.
(4) The starch concentration is greater at point *B* than it is at point *A*.

6 The diagram below provides some information concerning proteins.



Which phrase is represented by *A*?

(1) sequence of amino acids
(2) sequence of simple sugars
(3) sequence of starch molecules
(4) sequence of ATP molecules

7 In a certain ecosystem, rattlesnakes are predators of prairie dogs. If the prairie dog population started to increase, how would the ecosystem most likely regain stability?

(1) The rattlesnake population would start to decrease.
(2) The rattlesnake population would start to increase.
(3) The prairie dog population would increase rapidly.
(4) The prairie dog population would begin to prey on the rattlesnakes.

8 In a particular variety of corn, the kernels turn red when exposed to sunlight. In the absence of sunlight, the kernels remain yellow. Based on this information, it can be concluded that the color of these corn kernels is due to

(1) a different type of DNA that is produced when sunlight is present
(2) a different species of corn that is produced in sunlight
(3) the effect of sunlight on the number of chromosomes inherited
(4) the effect of environment on gene expression

9 What determines the kind of genes an organism possesses?

(1) type of amino acids in the cells of the organism
(2) sequence of the subunits A, T, C, and G in the DNA of the organism
(3) size of simple sugar molecules in the organs of the organism
(4) shape of the protein molecules in the organelles of the organism

10 If a set of instructions that determines all of the characteristics of an organism is compared to a book, and a chromosome is compared to a chapter in the book, then what might be compared to a paragraph in the book?

(1) a starch molecule
(2) an egg
(3) an amino acid
(4) a DNA molecule

11 Research applications of the basic principles of genetics have contributed greatly to the rapid production of new varieties of plants and animals. Which activity is an example of such an application?

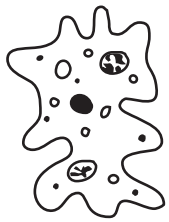
(1) testing new fertilizers on food crops
(2) selective breeding of plants and animals that exhibit high resistance to disease
(3) developing new irrigation methods to conserve water
(4) using natural predators to control insect pests

12 People with cystic fibrosis inherit defective genetic information and cannot produce normal CFTR proteins. Scientists have used gene therapy to insert normal DNA segments that code for the missing CFTR protein into the lung cells of people with cystic fibrosis. Which statement does *not* describe a result of this therapy?

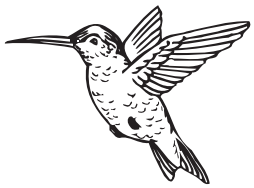
(1) Altered lung cells can produce the normal CFTR protein.
(2) Altered lung cells can divide to produce other lung cells with the normal CFTR gene.
(3) The normal CFTR gene may be expressed in altered lung cells.
(4) Offspring of someone with altered lung cells will inherit the normal CFTR gene.

13 Two organisms are represented below.

Single-celled Organism A



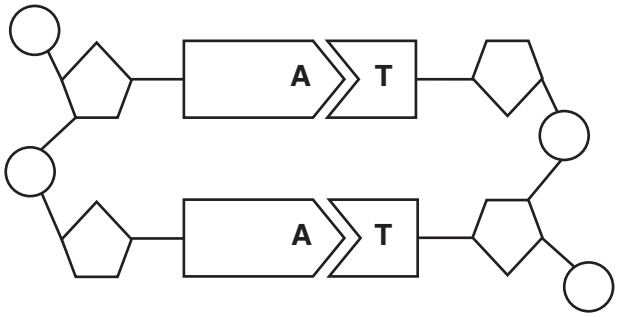
Multicellular Organism B



Which statement concerning organism *A* and organism *B* is correct?

(1) Organism *A* contains tissues while organism *B* lacks tissues.
(2) Organism *A* and organism *B* have the same organs.
(3) Organism *A* and organism *B* have structures that allow them to maintain homeostasis.
(4) Organism *A* lacks structures that maintain a dynamic equilibrium, while organism *B* has these structures.

14 A portion of a molecule is shown in the diagram below.



Which statement best describes the main function of this type of molecule?

(1) It is a structural part of the cell wall.
(2) It stores energy for metabolic processes.
(3) It determines what traits may be inherited.
(4) It transports materials across the cell membrane.

15 The structure that makes nutrients most directly available to a human embryo is the

(1) gamete
(2) ovary
(3) stomach
(4) placenta

16 Which process is correctly matched with its explanation?

	Process	Explanation
(1)	extinction	adaptive characteristics of a species are not adequate
(2)	natural selection	the most complex organisms survive
(3)	gene recombination	genes are copied as a part of mitosis
(4)	mutation	overproduction of offspring takes place within a certain population

17 The great variety of possible gene combinations in a sexually reproducing species is due in part to the

(1) sorting of genes as a result of gene replication
(2) pairing of genes as a result of mitosis
(3) pairing of genes as a result of differentiation
(4) sorting of genes as a result of meiosis

18 The information below was printed on a calendar of important events in the field of biology.

1859
Darwin Publishes
On the Origin of Species by Natural Selection

This information is most closely associated with

(1) an explanation for the change in types of minerals in an area through ecological succession
(2) the reasons for the loss of biodiversity in all habitats on Earth
(3) an attempt to explain the structural similarities observed among diverse living organisms
(4) the effect of carrying capacity on the size of populations

19 The Florida panther, a member of the cat family, has a population of fewer than 100 individuals and has limited genetic variation. Which inference based on this information is valid?

(1) These animals will begin to evolve rapidly.
(2) Over time, these animals will become less likely to survive in a changing environment.
(3) These animals are easily able to adapt to the environment.
(4) Over time, these animals will become more likely to be resistant to disease.

20 Areas with many different niches will most likely have

(1) large numbers of organisms that will become extinct
(2) no organisms that will become extinct
(3) little diversity among the organisms
(4) great diversity among the organisms

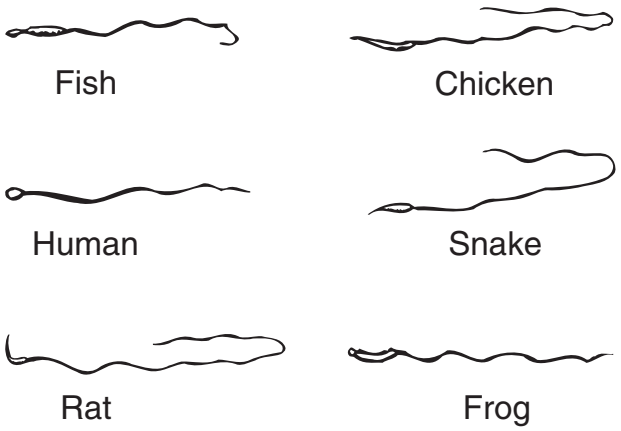
21 From a single monkey, an animal breeder claims that he has successfully cloned two monkeys. He displays the two monkeys, a male and a female, to the public. The claim of the breeder should be rejected because the monkeys

(1) are twins
(2) have the same parents
(3) are of two different sexes
(4) developed from more than one sperm cell

22 Compared to human cells resulting from mitotic cell division, human cells resulting from meiotic cell division would have

(1) twice as many chromosomes
(2) the same number of chromosomes
(3) one-half the number of chromosomes
(4) one-quarter as many chromosomes

23 The diagrams below represent cells that transport chromosomes.



These cells are specialized for

(1) oxygen transport
(2) transmitting chemical signals over long distances
(3) sexual reproduction
(4) injecting antibodies into harmful bacteria

24 Living organisms must be able to obtain materials, change the materials into new forms, remove poisons, and move needed material from one place to another. Many of these activities directly require

(1) energy released from ATP
(2) carbohydrates formed from receptor molecules
(3) the synthesis of DNA
(4) the breakdown of energy-rich inorganic molecules

25 A colony of bacteria growing on a culture medium is successfully synthesizing an organic compound. Which procedure would be *least* likely to have an effect on this synthesis?

(1) adding more subunits of the organic compound to the medium
(2) lowering the pH of the medium
(3) raising the temperature of the colony from 20°C to 30°C
(4) increasing the number of hormone molecules in the colony

26 Which process is directly used by autotrophs to store energy in glucose?

(1) diffusion
(2) photosynthesis
(3) respiration
(4) active transport

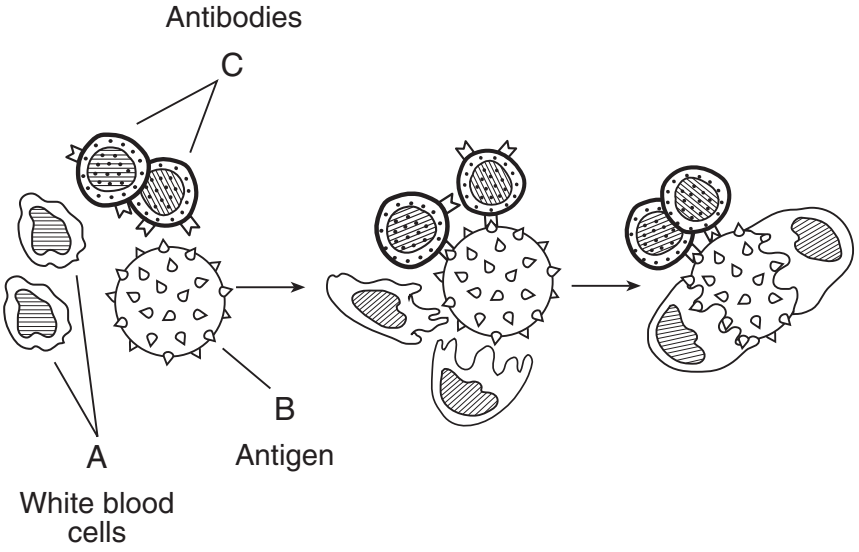
27 The ozone layer of Earth's atmosphere helps to filter ultraviolet radiation. As the ozone layer is depleted, more ultraviolet radiation reaches Earth's surface. This increase in ultraviolet radiation may be harmful because it can directly cause

(1) photosynthesis to stop in all marine organisms
(2) abnormal migration patterns in waterfowl
(3) mutations in the DNA of organisms
(4) sterility in most species of mammals and birds

28 In an ecosystem, nutrients would be recycled if they were transferred directly from herbivores to carnivores to

(1) hosts
(2) prey
(3) decomposers
(4) autotrophs

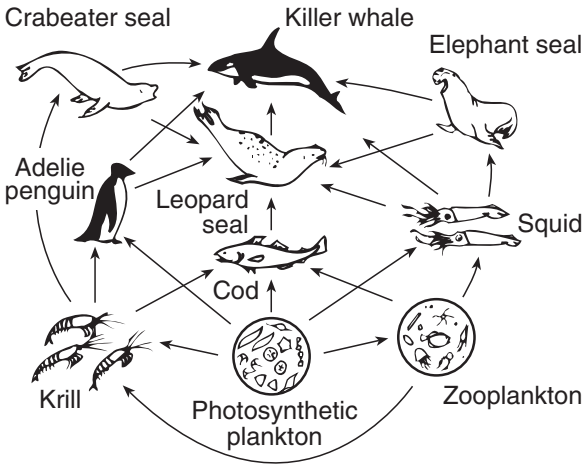
29 The diagram below represents one possible immune response that can occur in the human body.



The structures that are part of the immune system are represented by

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

30 Which statement concerning the producers in the ocean ecosystem shown below is correct?

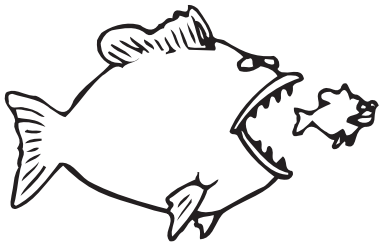


(1) An increase in the types of producers will most likely decrease the available energy for the squid.
(2) A producer in this ecosystem is the zooplankton.
(3) If all the producers in this ecosystem are destroyed, the number of heterotrophs will increase, but the ecosystem will reach a new equilibrium.
(4) Since there is only one group of producers, their numbers must be large enough to supply the energy for the rest of the food web.

31 Which factor has the greatest influence on the variety of species that survive in different regions of a marine habitat?

(1) depth of light penetration
(2) daily fluctuations in temperature
(3) size of predators
(4) average annual rainfall

32 Which group contains terms that are *all* directly associated with one of the organisms shown in the diagram below?



(1) herbivore, prey, autotroph, host
(2) predator, scavenger, decomposer, consumer
(3) carnivore, predator, heterotroph, multicellular
(4) producer, parasite, fungus, fish

33 Which set of statements best illustrates a material cycle in a self-sustaining ecosystem?

(1) In summer, growing plants remove magnesium ions from the soil to make chlorophyll. In autumn, these plants release magnesium when they die and decompose. In spring, new plants will grow in this same area.
(2) Trees do not live in a desert ecosystem where there is not enough water present in the sandy soil to support their growth. Trees can live in a desert oasis.
(3) DDT is sprayed on a forest ecosystem to control the mosquito population. After a year, the level of DDT is found to be much higher in the tissues taken from a hawk than in the tissues taken from a mouse in this ecosystem.
(4) Plants trap the Sun's energy in the chemical bonds of organic molecules. This energy is then used for plant metabolic activities.

34 Imported animal species often disrupt an ecosystem because in their new environment, they will most likely

(1) eliminate the genetic variation of the autotrophs
(2) increase the number of mutations in the herbivores
(3) have no natural enemies
(4) be unable to produce offspring

35 A major reason that humans have negatively affected the environment in the past is that humans have

(1) frequently lacked an understanding of how their activities affect the environment
(2) passed laws to protect certain wetlands
(3) attempted to control their population growth
(4) discontinued the use of certain chemicals used to control insects

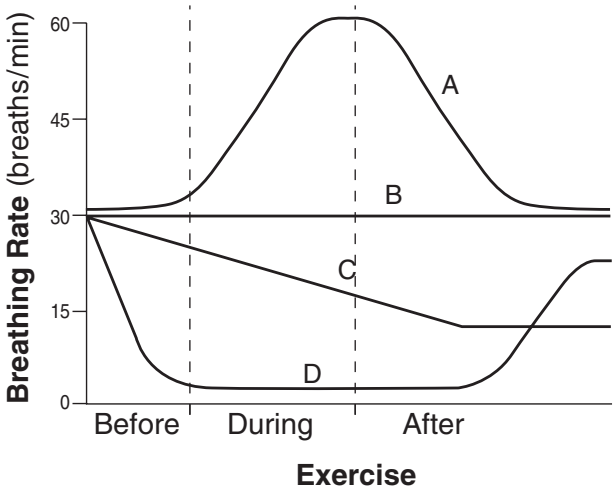
Part B

Answer all questions in this part. [30]

Directions (36–65): For those questions that are followed by four choices, circle the number of the choice that best completes the statement or answers the question. For all other questions in this part, follow the directions given in the question and record your answers in the spaces provided.

For Teacher Use Only

36 Which line in the graph below best illustrates an effect of the carbon dioxide level in the blood on breathing rate before, during, and after a period of exercise?



(1) *A*

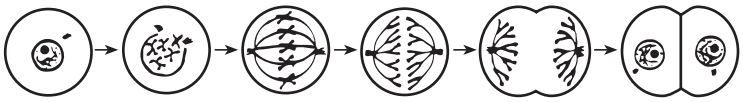
(2) *B*

(3) *C*

(4) *D*

36 ☐

37 Which activity most directly involves the process represented in the diagram below?



(1) a gamete reproducing sexually

(2) a white blood cell engulfing bacteria

(3) a zygote being produced in an ovary

(4) an animal repairing damaged tissue

37 ☐

38 Events that occur in four different ecosystems are shown in the chart below.

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Ecosystem	Events
A	A severe ice storm occurs during the winter, damaging trees and shrubs. No ice storms occur for the next 20 years.
B	A severe drought causes most of the leaves to fall from the trees during a single summer. There are no serious droughts for the next 20 years.
C	An island with a dense shrub population becomes submerged for 3 years. When the river water lowers, the island does not become submerged for the next 20 years.
D	A fire burns through a large grassy area. Fires do not occur in the area for the next 20 years.

Which ecosystem would most likely require the most time for ecological succession to restore it to its original state?

(1) *A*

(2) *B*

(3) *C*

(4) *D*

38 ☐

39 A slide of human blood cells was observed in focus under the low-power objective of a compound light microscope that had clean lenses. When the microscope was switched to high power, the image was dark and fuzzy. Which parts of the microscope should be used to correct this situation?

(1) nosepiece and coarse adjustment

(2) diaphragm and ocular

(3) objective and fine adjustment

(4) diaphragm and fine adjustment

39 ☐

Base your answers to questions 40 and 41 on the information below and on your knowledge of biology.

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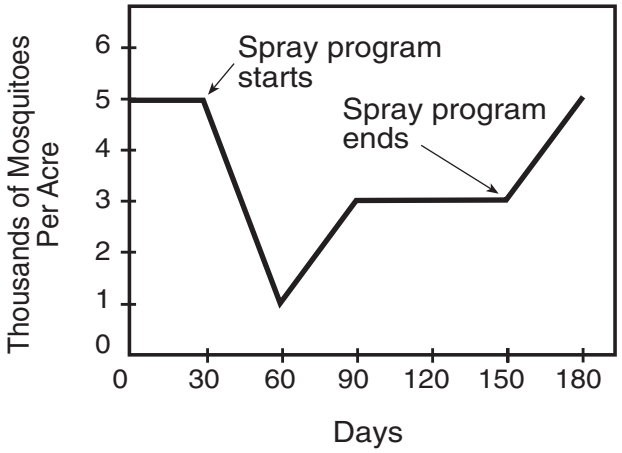
A small village was heavily infested with mosquitoes. The village was sprayed weekly with an insecticide for a period of several months. The results of daily counts of the mosquito population are shown in the graph below.



40 Which statement best explains why some mosquitoes survived after the first spraying?

(1) Some mosquitoes were adapted to the climatic change that occurred over the several-month period of spraying.

(2) All of the mosquitoes contained DNA unique to the species.

(3) The spraying of the insecticide represented a change in the environment to which all adult mosquitoes were adapted.

(4) A natural variation existed within the mosquito population.

40 ☐

41 Which statement best explains the decreased effectiveness of the insecticide?

(1) The insecticide caused mutations that resulted in immunity in the mosquito.

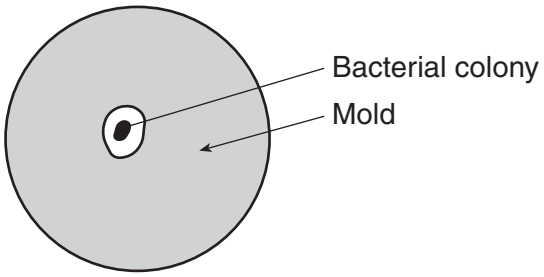
(2) Mosquitoes resistant to the insecticide lived and produced offspring.

(3) The insecticide reacted chemically with the DNA of the mosquitoes and was destroyed.

(4) All of the mosquitoes produced antibodies that activated the insecticide.

41 ☐

42 The diagram below represents a petri dish containing nutrient agar. A single bacterial colony is growing on the surface of the agar. A mold, represented by the shaded area, is also growing on the agar surface.



Which statement best explains why no mold is growing in the white area next to the bacterial colony?

(1) The mold cannot use the nutrient agar for food.

(2) The bacteria may release a substance that prevents mold growth.

(3) The mold is causing the bacterial colony to reproduce faster.

(4) The bacteria are scavengers of the growing mold.

42 ☐

43 Identify a piece of laboratory equipment that normally would be used to accurately measure 5 milliliters of glucose solution for an experiment. [1]

_____

43 ☐

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Base your answers to questions 44 and 45 on the two sets of cell organelles in the chart below and on your knowledge of biology.

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	Set A	Set B
Organelle 1	Ribosome	Mitochondrion
Organelle 2	Nucleus	Cell membrane

44 Select *one* set of organelles and record the letter of the set. Identify a cellular process that is accomplished by organelle 1 in the set you selected. [1]

Set: _____

_____ 44 ☐

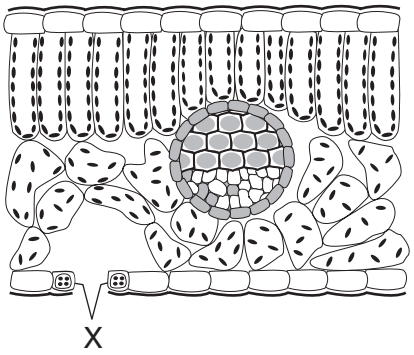
45 Explain how the two organelles in the set you selected interact to carry out the cellular process you identified in question 44. [1]

_____

_____

_____ 45 ☐

46 The diagram below represents a cross section of a leaf.



Explain how the structures labeled X function to maintain homeostasis in a plant. [1]

_____

_____

_____ 46 ☐

Base your answers to questions 47 and 48 on the graph below which shows pollution from nitrogen-containing compounds (nitrates) in a brook flowing through a deforested and a forested area between 1965 and 1968.

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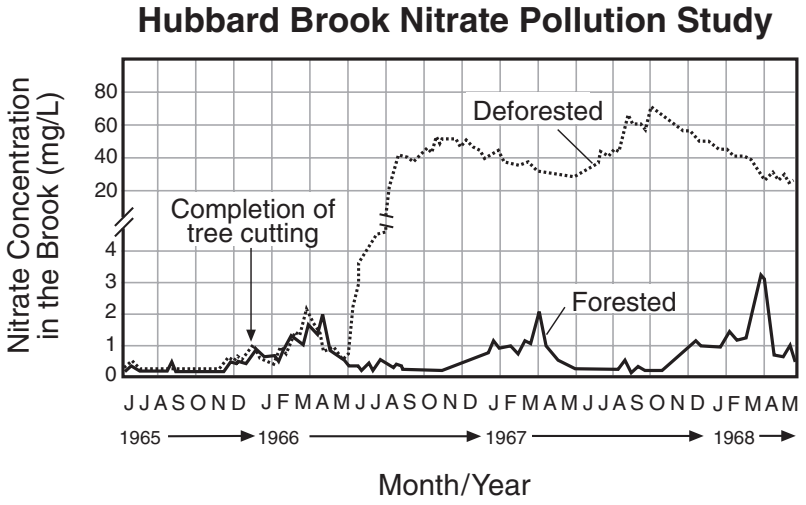

47 State how nitrate pollution in the brook changed after the brook flowed through the deforested area. [1]

_____

_____

_____

47 ☐

48 Explain how deforestation contributed to this change. [1]

_____

_____

_____

48 ☐

Base your answers to questions 49 through 52 on the information below and on your knowledge of biology.

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Duckweed is one of the smallest flowering aquatic plants. It grows floating on still or slow-moving fresh water. Duckweed species are found throughout the world, except in very cold regions, and are the subject of much scientific research. The plants are used to study basic plant biochemistry, plant development, and photosynthesis. Environmental scientists are using duckweed plants to remove hazardous substances from water. Fish farmers use them as an inexpensive food source for the fish they raise. As with other aquatic plants, duckweed grows best in water containing high levels of nitrates (nitrogen compounds) and phosphates. The level of iron-containing compounds is often a limiting factor. A cover of duckweed on a pond shades the water below and reduces the growth of algae. A key for identifying duckweed is shown below.

Duckweed Identification Key

	Plant Has No Root	**Plant Has One or More Roots**
Plant body is flat	*Wolffiella*	
Plant body is oval (less than 1 mm)	*Wolffia*	
Plant has one midsize root		*Lemma*
Plant has two or more large-size roots		*Spirodela*

49 Explain the value duckweed has for the heterotrophic organisms in a pond where duckweed grows. [1]

_____

_____

_____ 49 ☐

50 Explain what is meant by the statement, "The level of iron-containing compounds is often a limiting factor." [1]

_____

_____

_____ 50 ☐

51 State *one* way in which shading the water below the duckweed affects the growth of algae. [1]

_____

_____

_____

51 ☐

52 Explain why *Spirodela* would most likely absorb more hazardous substances from water than the other species of duckweed identified in the key. [1]

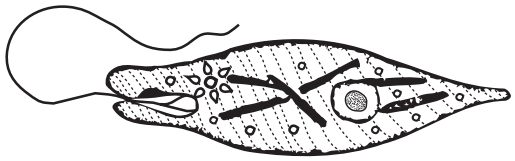
_____

_____

_____

52 ☐

Base your answers to questions 53 and 54 on the information and the diagram below which represents a single-celled organism known as *Euglena.*



Directions (53–54): This organism is able to carry out both photosynthesis and cellular respiration. Choose *one* of these processes and write the name of the process you chose below.

Process: _____

53 Using words or chemical symbols, summarize the reaction involved in the process you chose. [1]

_____

_____

_____

53 ☐

54 State *one* reason the process you chose is essential for the survival of the *Euglena*. [1]

_____

_____

_____

54 ☐

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Base your answers to questions 55 through 57 on the reading passage below and on your knowledge of biology.

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In 1869, the gypsy moth was imported from Europe into Massachusetts. Each gypsy moth caterpillar can eat more than 1 square meter of leaf tissue in its 8-week life, so by 1889 the residents of Boston began to notice many leafless trees.

Every few years, the population of gypsy moths rapidly increases in a season. In the course of two growing seasons, the number of eggs can range from 100 per acre to as many as 1 million per acre. In 1981, about 13 million acres of trees were defoliated (lost their leaves) in the American northeast, and many valuable oak trees died. Between 1979 and 1983, the cost of trying to control these pests totaled 24.2 million dollars. These attempts at control failed.

Rapid growth of a population occurs when there is an abundance of food or when an important environmental factor has been removed. Gypsy moth populations are normally kept in check by phenol chemicals that trees make and release into their leaves. These defensive chemicals stunt caterpillar growth and reduce the number of eggs a female can lay. After several years without caterpillars, the trees stop making these phenols. When this happens, the females eating the phenol-free leaves grow bigger and lay more eggs. Suddenly, a gypsy moth outbreak occurs again, and the cycle is repeated.

When a gypsy moth outbreak occurs, the surrounding ecosystem begins to change as well. Cuckoos, starlings, grackles, mice, and skunks feast on the extra caterpillars, and their numbers increase. All these natural enemies cannot stop the gypsy moth. Trees are stripped of their leaves, weaker trees die at once, and others grow a second set of leaves. If the trees that survive are attacked repeatedly, they also may be weakened beyond recovery.

55 Describe *one* condition that might cause the gypsy moth population to increase rapidly. [1]

_____

_____

_____ 55 ☐

56 State *one* reason that a rapid increase in a gypsy moth population may cause some species of herbivores to vanish or be reduced in number. [1]

_____

_____

_____ 56 ☐

57 State *one* way some producers protect themselves from gypsy moths. [1]

_____

_____

_____ 57 ☐

Base your answers to questions 58 through 60 on the table below, which represents the DNA codes for several amino acids.

For Teacher Use Only

Amino Acid	DNA Code Sequence
Cysteine	ACA *or* ACG
Tryptophan	ACC
Valine	CAA *or* CAC *or* CAG *or* CAT
Proline	GGA *or* GGC *or* GGG *or* GGT
Asparagine	TTA *or* TTG
Methionine	TAC

58 A certain DNA strand has the base sequence: TACACACAAACGGGG. In the space provided below, write the sequence of amino acids synthesized from this code if it is read from left to right. [1]

_____ 58 ☐

59 The DNA sequence undergoes the following change:

TACACACAAACGGGG → TACACCCAAACGGGG

How would the sequence of amino acids be changed as a result of this mutation? [1]

_____

_____

_____ 59 ☐

60 The original DNA sequence undergoes the following change:

TACACACAAACGGGG → TACACACAAACGGGT

State *one* reason this mutation produces *no change* in the action of the final molecule that will be synthesized from this code. [1]

_____

_____

_____ 60 ☐

Base your answers to questions 61 through 65 on the information below and on your knowledge of biology.

For Teacher Use Only

An investigation was carried out to measure the rate of activity of catalase, an enzyme that breaks down hydrogen peroxide. Five 40-mL solutions of the enzyme at concentrations of 20%, 40%, 60%, 80%, and 100% were prepared. A filter paper disk was placed in each enzyme solution. Each soaked disk from the different enzyme concentrations was then added to different cups containing 30 mL of 1% hydrogen peroxide. The rate of catalase activity was inferred from measurements of how fast the disks rose from the bottom to the top of each cup. The following data were obtained: 40%–12.1 seconds, 80%–5.8 seconds, 100%–4.1 seconds, 20%–15.8 seconds, and 60%–9.9 seconds.

Directions (61–62): Organize the data by completing the data table, according to the directions below.

61 Label the second column of the data table with an appropriate heading and record that label on the *y*-axis of the graph. [Be sure to include units.] [1]

62 Complete the data table so that the percent enzyme *increases* from the top to the bottom of the table. [1]

Enzyme Concentration (percent)	

61 ☐

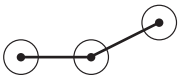
62 ☐

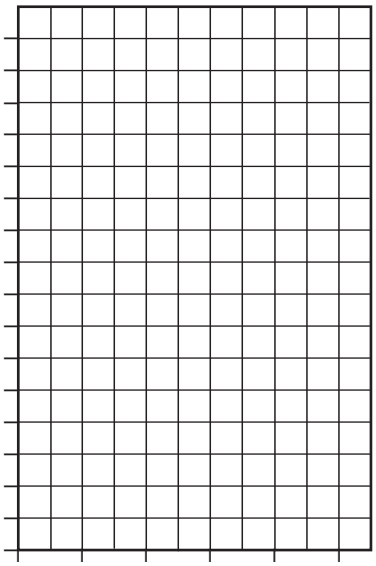
Directions (63–64): Using the information in the data table, construct a line graph on the grid provided, following the directions below.

For Teacher Use Only

63 Mark an appropriate scale on each axis. [1]

64 Plot the data from your data table. Surround each point with a small circle and connect the points. [1]

Example: 



Percentage of Catalase

63 ☐

64 ☐

65 State *one* valid conclusion that relates enzyme concentration to reaction rate. [1]

_____

_____

_____

65 ☐

Part C

Answer all questions in this part. [20]

Directions (66–72): Record your answers in the spaces provided in this examination booklet.

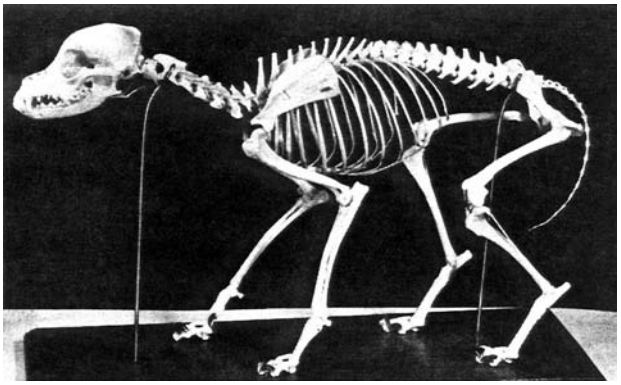
66 A television advertisement claims that a certain brand of cough drop reduces coughing for 8 hours. Describe an investigation that could be used to determine if this claim is valid. In your answer, include at least a description of:

- the treatment to be given to the experimental group [1]
- the treatment to be given to the control group [1]
- the data to be collected [1]
- when the data should be collected [1]
- *one* observation that would lead to the conclusion that the claim is valid [1]

For Teacher Use Only

66

67 The skeletal system of an animal is shown in the photograph below.



List *three* systems, other than the skeletal system, the animal had when alive that helped it to survive. Describe how each of these three systems contributed to maintaining homeostasis. [3]

(1) System: _____

_____

_____

_____

(2) System: _____

_____

_____

_____

(3) System: _____

_____

_____

_____

For Teacher Use Only

67 ☐

68 Some scientists are urging that immediate action be taken to stop activities that contribute to global warming. Discuss the effects of global warming on the environment and describe some human activities that may contribute to it. Your answer *must* include:

- an explanation of what is meant by the term *global warming* [1]
- *one* human activity that is thought to be a major contributor to global warming and an explanation of how it may contribute to the problem [2]
- *one* negative effect of global warming if it continues for many years [1]

For Teacher Use Only

68

Base your answers to questions 69 through 71 on the information below and on your knowledge of biology.

For Teacher Use Only

Egg Laying vs. Bearing Live Young

Three groups of animals in which most species lay eggs for reproduction are amphibians, reptiles, and birds. Most female amphibians lay hundreds of eggs in water, which are then fertilized by sperm from the male. Many reptiles lay between 1 and 200 eggs at a time, often in nests on land. The eggs have a leathery shell. Birds usually lay between one and four eggs at a time in nests on land. Wild bird eggs usually have shells similar to those of the domestic chicken.

Most mammals bear live young. Some of these mammals, humans, for example, usually give birth to one live offspring at a time.

69 State *one* reason that individuals of some species must lay hundreds of eggs in order for the species to survive. [1]

_____

_____

_____

69 ☐

70 Explain why fertilization in reptiles and birds must be internal. [1]

_____

_____

_____

70 ☐

71 State *two* reasons that the human species has been able to survive, even though usually only one offspring is born at a time. [2]

(1) _____

_____

(2) _____

_____

71 ☐

Base your answer to question 72 on the information below and on your knowledge of biology.

Immunization protects the human body from disease. The success of vaccinations can be seen in the fact that smallpox has been eliminated worldwide from the list of common infectious diseases. The only remaining smallpox viruses on Earth are thought to be those kept in certain research laboratories.

The United States is now committed to the goal of immunizing all children against common childhood diseases. However, many parents are choosing not to immunize their children against childhood diseases such as diphtheria, whooping cough, and polio.

For example, the mother of a newborn baby is concerned about having her child receive the DPT (diphtheria, whooping cough, and tetanus) vaccine. Since these diseases are caused by bacteria, she believes antibiotic therapy is a safe alternative to vaccination.

72 Discuss the use of antibiotics and vaccines in the treatment and prevention of bacterial diseases. In your answer be sure to include:

- what is in a vaccine [1]
- how a vaccine promotes immunity [1]
- *one* advantage of the use of vaccinations to fight bacterial diseases [1]
- *one* disadvantage of the use of antibiotics to fight bacterial diseases [1]

For Teacher Use Only

72 ☐

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Wednesday, August 13, 2003 — 12:30 to 3:30 p.m., only

ANSWER SHEET

Student ..... Sex: ☐ Female ☐ Male

Teacher .....

School ..... Grade .....

Part	Maximum Score	Student's Score
A	35	
B	30	
C	20	
Total Raw Score (maximum Raw Score: 85)		
Final Score (from conversion chart)		

Raters' Initials

Rater 1 ..... Rater 2 .....

Record your answers to Part A on this answer sheet.

Part A

1	13	25 .....
2	14	26 .....
3	15	27 .....
4	16	28 .....
5	17	29 .....
6	18	30 .....
7	19	31 .....
8	20	32 .....
9	21	33 .....
10	22	34 .....
11	23	35 .....
12	24	

The declaration below must be signed when you have completed the examination.

I do hereby affirm, at the close of this examination, that I had no unlawful knowledge of the questions or answers prior to the examination and that I have neither given nor received assistance in answering any of the questions during the examination.

Signature

Tear Here

Tear Here

Tear Here

FOR TEACHERS ONLY

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

Le

LIVING ENVIRONMENT

Wednesday, August 13, 2003 — 12:30 p.m. to 3:30 p.m., only

SCORING KEY AND RATING GUIDE

Directions to the Teacher:

Refer to the directions on page 3 before rating student papers.

Part A (35 credits)

Allow a total of 35 credits for Part A, one credit for each correct answer.

(1)	**1**	**(13)**	**3**	**(25)**	**4**
(2)	**1**	**(14)**	**3**	**(26)**	**2**
(3)	**2**	**(15)**	**4**	**(27)**	**3**
(4)	**4**	**(16)**	**1**	**(28)**	**3**
(5)	**2**	**(17)**	**4**	**(29)**	**2**
(6)	**1**	**(18)**	**3**	**(30)**	**4**
(7)	**2**	**(19)**	**2**	**(31)**	**1**
(8)	**4**	**(20)**	**4**	**(32)**	**3**
(9)	**2**	**(21)**	**3**	**(33)**	**1**
(10)	**4**	**(22)**	**3**	**(34)**	**3**
(11)	**2**	**(23)**	**3**	**(35)**	**1**
(12)	**4**	**(24)**	**1**		

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 Administering and Scoring Regents Examinations in the Sciences*.

Use only *red* ink or *red* pencil in rating Regents papers. Do not attempt to *correct* the student's work by making insertions or changes of any kind.

Allow 1 credit for each correct response for multiple-choice questions in Part A and Part B.

On the detachable answer sheet for Part A, indicate by means of a checkmark each incorrect or omitted answer to multiple-choice questions. In the box provided in the upper right corner of the answer sheet, record the number of questions the student answered correctly for that part.

At least two science teachers must participate in the scoring of the Part B and Part C 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 all the open-ended questions on a student's answer paper.

Students' responses must be scored strictly according to the Scoring Key and 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. In the student's examination booklet, record the number of credits earned for each answer in the box printed to the right of the answer lines or spaces for that question.

Fractional credit is *not* allowed. Only whole-number credit may be given to 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.

Raters should enter the scores earned for Part A, Part B, and Part C on the appropriate lines in the box printed on the answer sheet and should add these 3 scores and enter the total in the box labeled "Total Raw Score." Then the student's raw score should be converted to a scaled score by using the conversion chart printed at the end of this Scoring Key and Rating Guide. The student's scaled score should be entered in the labeled box on the student's answer booklet. The scaled score is the student's final examination score.

Part B

36 1

37 4

38 3

39 4

40 4

41 2

42 2

43 Allow 1 credit for **graduated cylinder** or another acceptable response.

44 Allow 1 credit for identifying the correct cellular process.

Set *A*: protein synthesis
Set *B*: respiration

45 Allow 1 credit for explaining how the two organelles in the set selected interact to carry out the cellular process identified. Acceptable responses include, but are not limited to:

Set *A*: The nucleus contains DNA that provides the code to make proteins at the ribosome.

Set *B*: The cell membrane allows substances (such as O_2 and sugars) needed by mitochondria for cellular respiration to enter the cell.

46 Allow 1 credit for explaining how the structures labeled *X* function to maintain homeostasis in a plant. Acceptable responses include, but are not limited to:

— regulate the movement of gases into and out of the leaf
— control the size of the leaf openings
— regulate water loss

47 Allow 1 credit for stating that nitrate pollution increased.

48 Allow 1 credit for explaining how deforestation contributed to this change. Acceptable responses include, but are not limited to:

— Trees absorb nitrates and when trees are removed, fewer nitrates are absorbed.
— Nitrates from top soil are washed into the brook.
— Nitrogen cycles are disrupted in deforested areas.
— Debris from deforestation entered the brook and decomposed.
— Deforestation increases nitrate runoff into the brook.

49 Allow 1 credit for explaining the value duckweed has for the heterotrophic organisms in a pond. Acceptable responses include, but are not limited to:

— Heterotrophic organisms can use duckweed as a food source.
— Duckweed produces O_2 for heterotrophs.
— Duckweed removes hazardous materials from water.

50 Allow 1 credit for explaining the statement, "The level of iron-containing compounds is often a limiting factor." Acceptable responses include, but are not limited to:

— The iron in the pond/lake can influence the size of the duckweed population.
— Too much iron may reduce the size of the duckweed population.
— Too little iron may reduce the size of the duckweed population.

51 Allow 1 credit for stating one way in which shading the water below the duckweed affects the growth of algae. Acceptable responses include, but are not limited to:

— The shading reduces the growth of algae.
— Shading reduces the rate of photosynthesis in algae, making less food available for growth.
— Shading reduces the oxygen available for algae.

52 Allow 1 credit for explaining why *Spirodela* would most likely absorb more hazardous substances from water than other species of duckweed. Acceptable responses include, but are not limited to:

— Plants have 2 or more large-sized roots.
— larger surface area in roots
— larger roots

Note: Do *not* allow credit for merely stating that the plant has roots.

53 Allow 1 credit for using words or chemical symbols to summarize the reaction involved in the process. Acceptable responses include, but are not limited to:

Photosynthesis:
— carbon dioxide + water → glucose + oxygen
— $CO_2 + H_2O$ + sunlight → $C_6H_{12}O_6 + O_2$
— $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$
— $CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2 + H_2O$
— Radiant energy is converted into chemical bond energy.

Cellular respiration:
— glucose + oxygen → carbon dioxide + water + ATP
— $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$ + energy
— $C_6H_{12}O_6 + O_2 \rightarrow CO_2 + H_2O$
— Energy is released from food.

54 Allow 1 credit for stating one reason this process is essential for the survival of the *Euglena*. Acceptable responses include, but are not limited to:

— Photosynthesis produces food (or oxygen).
— Respiration provides energy.

55 Allow 1 credit for describing one condition that might cause the gypsy moth population to increase rapidly. Acceptable responses include, but are not limited to:

— Trees do not produce phenol.
— increase in number of eggs produced
— abundance of food
— removal of limiting factors
— larger females
— phenol resistant moths

56 Allow 1 credit for stating one reason that a rapid increase in a gypsy moth population may cause some species of herbivores to vanish or be reduced in number. Acceptable responses include, but are not limited to:

— Gypsy moths outcompete other herbivores that feed on trees.
— Other herbivores are denied food, so their populations decline.
— Bare trees can't protect herbivores that hide in trees from carnivores.

57 Allow 1 credit for stating that plants produce phenol chemicals.

58 Allow 1 credit for writing the sequence of amino acids.

methionine – cysteine – valine – cysteine – proline

59 Allow 1 credit for indicating how the sequence of amino acids would change. Acceptable responses include, but are not limited to:

— methionine – tryptophan – valine – cysteine – proline
— The first cysteine would be replaced by tryptophan.

60 Allow 1 credit for stating one reason this mutation will not cause a change in the action of the final molecule. Acceptable responses include, but are not limited to:

— GGG and GGT both code for proline.
— The same molecule will be produced.
— The last three bases still code for proline.
— The same amino acid sequence is produced.

61 Allow 1 credit for appropriately labeling the second column of the data table and indicating units (e.g. Disk Rising Time (seconds)) and recording that label on the *y*-axis of the graph with appropriate units.

62 Allow 1 credit for completing the data table so that the percent enzyme increases from the top to the bottom of the table.

61–62

Example of a 2-Credit Data Table

Enzyme Concentration (percent)	**Disk Rising Time** (seconds)
20	15.8
40	12.1
60	9.9
80	5.8
100	4.1

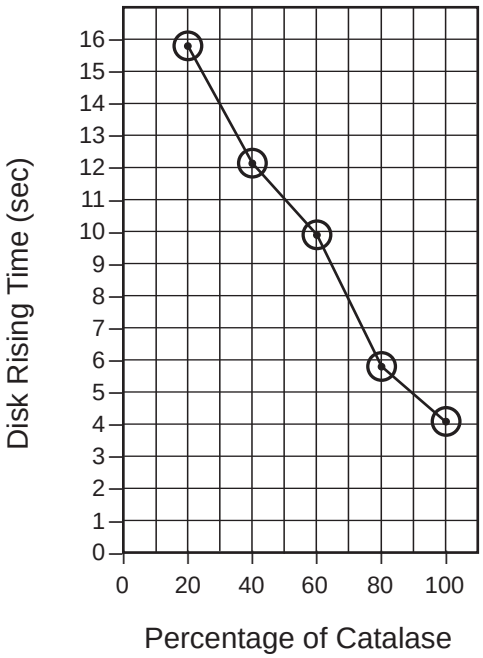
63 Allow 1 credit for marking an appropriate scale on both the *x*- and *y*-axes.

Note: Allow credit for an answer that is consistent with the student's responses to questions 61 and 62.

64 Allow 1 credit for plotting the data correctly and connecting the points.

Note: Credit may be allowed if the points are plotted correctly, but not circled.

Example of a 2-Credit Graph



65 Allow 1 credit for stating one valid conclusion relating enzyme concentration to reaction rate. Acceptable responses include but are not limited to:

— As the concentration of the catalase enzyme increases, the rate of the reaction increases.
— More enzyme causes a faster reaction.
— As the enzyme concentration decreases, the reaction rate decreases.

Part C

66 Allow a maximum of 5 credits, 1 credit each for a description of:

- the treatment to be given to the experimental group (e.g., a certain brand of cough drop)
- the treatment to be given to the control group (e.g., hard candy without cough drop's active ingredients *or* no cough medicine at all)
- the data to be collected (e.g., number of coughs *or* depth of coughing *or* length of time between coughs)
- when the data should be collected (e.g., every minute, hour *or* under various conditions such as sleep, rest, or activity)
- one observation that would lead to the conclusion that the claim is valid (e.g., the experimental group had fewer coughs per time unit than the control group)

67 Allow a maximum of 3 credits, 1 credit each for any vertebrate body system, other than the skeletal system, with a description of how that system contributed to maintaining homeostasis. Acceptable responses include, but are not limited to:

— excretory system: removed wastes from the body
— digestive system: changed parts of food to molecules that diffused across membranes to cells
— respiratory system: exchanged gases
— circulatory system: carried food and/or oxygen to the cells

68 Allow a maximum of 4 credits for discussing the effects of global warming on the environment, allocated as follows:

- Allow 1 credit for an explanation of what is meant by the term *global warming* (e.g., global warming is an increase in average temperature of the atmosphere)

- Allow 1 credit for stating one human activity that is thought to be a major contributor to global warming and allow 1 credit for an explanation of how this activity may contribute to the problem. Acceptable responses include, but are not limited to:

Human Activity	Explanation
burning fossil fuels	adds CO_2 to atmosphere
factories / cars	adds CO_2 to atmosphere
deforestation	reduces photosynthesis reduces CO_2 removal from the atmosphere

- Allow 1 credit for one negative effect of global warming if it continues for many years. Acceptable responses include, but are not limited to:

  — melting of polar icecaps / major flooding
  — too hot for people to live
  — increase in disease

  Note: Do *not* give credit for indicating that Earth will get hotter unless accompanied by further information that illustrates a negative effect.

69 Allow 1 credit for stating one reason that individuals of some species must lay hundreds of eggs in order for the species to survive. Acceptable responses include, but are not limited to:

— Many eggs do not get fertilized.
— Many eggs are eaten by predators.
— The death rate for the developing young is very high.
— The eggs are exposed to hazards of the environment.

70 Allow 1 credit for explaining why fertilization in reptiles and birds must be internal. Acceptable responses include, but are not limited to:

— The egg is surrounded by a shell that the sperm could not penetrate outside the body of the female.
— The sperm must fertilize the egg before the shell is formed.

71 Allow a maximum of 2 credits, 1 for each of 2 reasons that the human species has been able to survive even though usually only one offspring is born at a time. Acceptable responses include, but are not limited to:

— The human fetus is well protected.
— The human baby is protected after birth.
— The developing human fetus is nourished internally.
— The developing human fetus is not exposed to the external environment.

72 Allow a maximum of 4 credits for discussing the use of antibiotics and vaccines in the treatment and prevention of bacterial diseases. The response must include:

- what is in a vaccine (e.g., dead or weakened bacteria) [1]
- how a vaccine promotes immunity (e.g., stimulates antibody production) [1]
- one advantage of the use of vaccinations to fight bacterial diseases (e.g., usually, you will not get the disease or vaccinations provide immunity that lasts a long time) [1]
- one disadvantage of the use of antibiotics to fight bacterial diseases (e.g., do not provide protection against future attacks; bacteria may become resistant; allergies to antibiotics; target beneficial bacteria) [1]

Regents Examination in Living Environment

August 2003

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

Raw Score	Scaled Score	Raw Score	Scaled Score	Raw Score	Scaled Score
85	100	56	77	27	51
84	99	55	76	26	50
83	98	54	75	25	49
82	97	53	75	24	48
81	96	52	74	23	46
80	95	51	73	22	45
79	94	50	73	21	43
78	93	49	72	20	42
77	92	48	71	19	40
76	91	47	71	18	39
75	90	46	70	17	37
74	90	45	69	16	35
73	89	44	68	15	33
72	88	43	67	14	32
71	87	42	67	13	30
70	86	41	66	12	28
69	86	40	65	11	26
68	85	39	64	10	24
67	84	38	63	9	22
66	84	37	62	8	20
65	83	36	61	7	17
64	82	35	60	6	15
63	81	34	59	5	13
62	81	33	58	4	10
61	80	32	57	3	8
60	79	31	56	2	5
59	79	30	55	1	3
58	78	29	54	0	0
57	77	28	53		

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 scaled score that corresponds to that raw score. The scaled score is the student's final examination score. Enter this score in the space labeled "Final Score" on the student's answer sheet.

All student answer papers that receive a scaled score of 60 through 64 **must** be scored a second time. For the second scoring, a different committee of teachers may score the student's paper or the original committee may score the paper, except that no teacher may score the same open-ended questions that he/she scored in the first rating of the paper. The school principal is responsible for assuring that the student's final examination score is based on a fair, accurate, and reliable scoring of the student's answer paper.

Because scaled scores corresponding to raw scores in the conversion chart may change from one examination to another, it is crucial that for each administration, the conversion chart provided in the scoring key for the administration be used to determine the student's final score. The chart above is usable only for this administration of the living environment examination.

Map to Core Curriculum

August 2003 Living Environment

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