

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

LIVING ENVIRONMENT

Thursday, August 16, 2001 — 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 with a total of 71 questions. 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 35 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 Which statement describes the best procedure to determine if a vaccine for a disease in a certain bird species is effective?

- (1) Vaccinate 100 birds and expose all 100 to the disease.
- (2) Vaccinate 100 birds and expose only 50 of them to the disease.
- (3) Vaccinate 50 birds, do not vaccinate 50 other birds, and expose all 100 to the disease.
- (4) Vaccinate 50 birds, do not vaccinate 50 other birds, and expose only the vaccinated birds to the disease.

2 Scientists have cloned sheep but have not yet cloned a human. The best explanation for this situation is that

- (1) the technology to clone humans has not been explored
- (2) human reproduction is very different from that of other mammals
- (3) there are many ethical problems involved in cloning humans
- (4) cloning humans would take too long

3 In an ecosystem, what happens to the atoms of certain chemical elements such as carbon, oxygen, and nitrogen?

- (1) They move into and out of living systems.
- (2) They are never found in living systems.
- (3) They move out of living systems and never return.
- (4) They move into living systems and remain there.

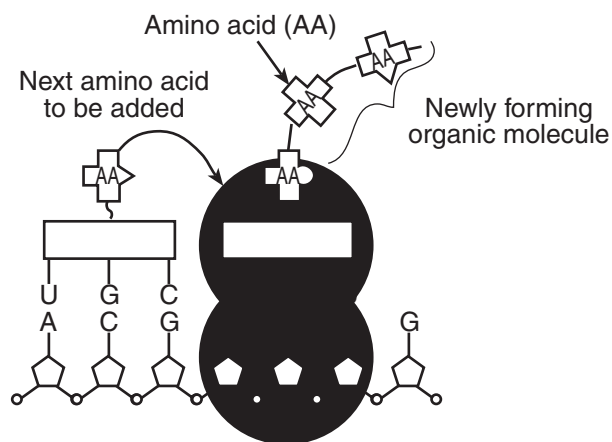
4 The main function of the human digestive system is to

- (1) rid the body of cellular waste materials
- (2) process organic molecules so they can enter cells
- (3) break down glucose in order to release energy
- (4) change amino acids into proteins and carbohydrates

5 The normal sodium level in human blood is 135 mEq/L. If a blood test taken immediately after a meal reveals a sodium level of 150 mEq/L, what will most likely result?

- (1) Antibody production will increase.
- (2) The person will move to an ecosystem with a lower sodium level.
- (3) The nutritional relationships between humans and other organisms will change.
- (4) An adjustment within the human body will be made to restore homeostasis.

6 The diagram below represents a process that occurs within a cell in the human pancreas.



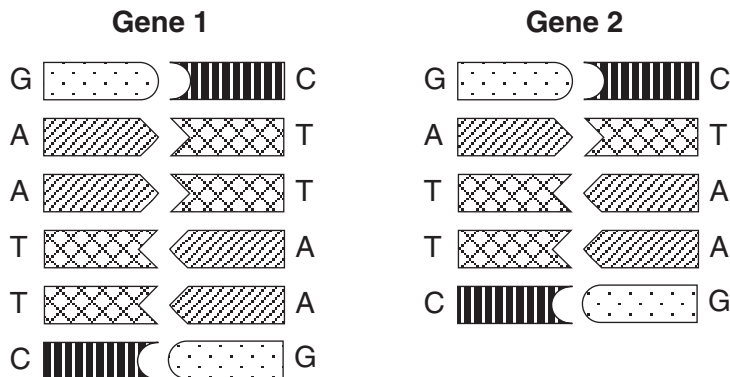
This process is known as

- (1) digestion by enzymes
- (2) protein synthesis
- (3) energy production
- (4) replication of DNA

7 When a person's teeth are being x rayed, other body parts of this person are covered with a protective lead blanket to prevent

- (1) loss of hair
- (2) increase in cell size
- (3) changes in DNA molecules
- (4) changes in glucose structure

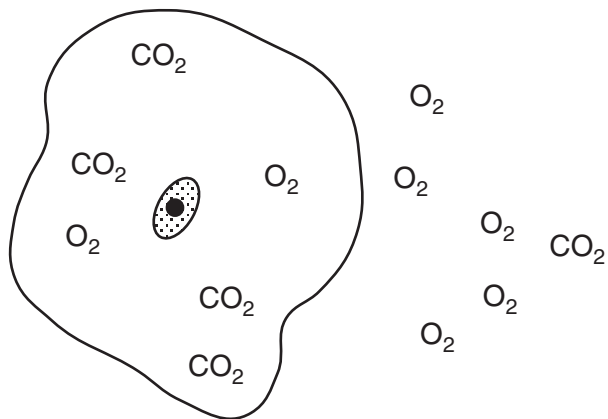
8 The diagrams below represent portions of the genes that code for wing structure in two organisms of the same species. Gene 1 was taken from the cells of a female with normal wings, and gene 2 was taken from the cells of a female with abnormal wings.



The abnormal wing structure was most likely due to

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

9 The diagram below represents a cell in water. Formulas of molecules that can move freely across the cell membrane are shown. Some molecules are located inside the cell and others are in the water outside the cell.



Based on the distribution of these molecules, what would most likely happen after a period of time?

- (1) The concentration of O₂ will increase inside the cell.
- (2) The concentration of CO₂ will remain the same inside the cell.
- (3) The concentration of O₂ will remain the same outside the cell.
- (4) The concentration of CO₂ will decrease outside the cell.

10 During the warm temperatures of summer, the arctic fox produces enzymes that cause its fur to become reddish brown. During the cold temperatures of winter, these enzymes do not function. As a result, the fox has a white coat that blends into the snowy background. This change in fur color shows that

- (1) the genes of a fox are made of unstable DNA
- (2) mutations can be caused by temperature extremes
- (3) random alteration of DNA can occur on certain chromosomes
- (4) the expression of certain genes is affected by temperature

11 Which phrases best identify characteristics of asexual reproduction?

- (1) one parent, union of gametes, offspring similar to but not genetically identical to the parent
- (2) one parent, no union of gametes, offspring genetically identical to parents
- (3) two parents, union of gametes, offspring similar to but not genetically identical to parents
- (4) two parents, no union of gametes, offspring genetically identical to parents

12 To determine the identity of their biological parents, adopted children sometimes request DNA tests. These tests involve comparing DNA samples from the child to DNA samples taken from the likely parents. Possible relationships may be determined from these tests because the

- (1) base sequence of the father determines the base sequence of the offspring
- (2) DNA of parents and their offspring is more similar than the DNA of nonfamily members
- (3) position of the genes on each chromosome is unique to each family
- (4) mutation rate is the same in closely related individuals

13 Although all the body cells in an animal contain the same hereditary information, they do not all look and function the same way. The cause of this difference is that during differentiation

- (1) embryonic cells use different portions of their genetic information
- (2) the number of genes increases as embryonic cells move to new locations
- (3) embryonic cells delete portions of chromosomes
- (4) genes in embryonic body cells mutate rapidly

14 According to the theory of natural selection, why are some individuals more likely than others to survive and reproduce?

- (1) Some individuals pass on to their offspring new characteristics they have acquired during their lifetimes.
- (2) Some individuals are better adapted to exist in their environment than others are.
- (3) Some individuals do not pass on to their offspring new characteristics they have acquired during their lifetimes.
- (4) Some individuals tend to produce fewer offspring than others in the same environment.

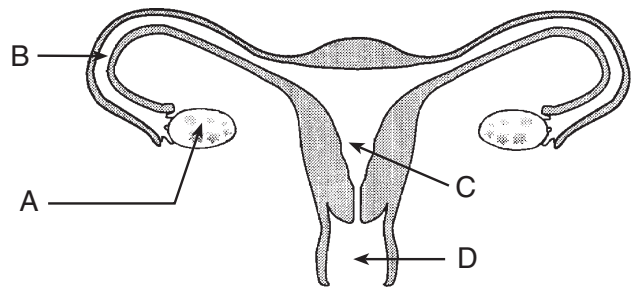
15 The energy an organism requires to transport materials and eliminate wastes is obtained directly from

- | | |
|------------|--------------|
| (1) DNA | (3) hormones |
| (2) starch | (4) ATP |

16 New inheritable characteristics would be *least* likely to result from

- (1) mutations which occur in muscle cells and skin cells
- (2) mutations which occur in male gametes
- (3) mutations which occur in female gametes
- (4) the sorting and recombination of existing genes during meiosis and fertilization

17 The diagram below shows the human female reproductive system.



The fetus normally develops within structure

- | | |
|-------|-------|
| (1) A | (3) C |
| (2) B | (4) D |

18 One way to produce large numbers of genetically identical offspring is by

- (1) cloning
- (2) fertilization
- (3) changing genes by agents such as radiation or chemicals
- (4) inserting a DNA segment into a different DNA molecule

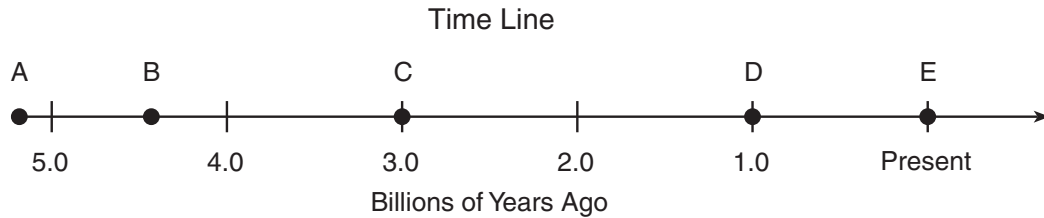
19 Most cells in the body of a fruit fly contain eight chromosomes. How many of these chromosomes were contributed by each parent of the fruit fly?

- | | |
|-------|--------|
| (1) 8 | (3) 16 |
| (2) 2 | (4) 4 |

20 Which disease damages the human immune system, leaving the body open to certain infectious agents?

- | | |
|----------|-----------------|
| (1) flu | (3) chicken pox |
| (2) AIDS | (4) pneumonia |

- 21 According to the interpretation of the fossil record by many scientists, during which time interval shown on the time line below did increasingly complex multicellular organisms appear on Earth?



- (1) A to B
 (2) B to C
 (3) C to D
 (4) D to E

- 22 Which characteristic of sexual reproduction has specifically favored the survival of animals that live on land?

- (1) fusion of gametes in the outside environment
 (2) male gametes that may be carried by the wind
 (3) fertilization within the body of the female
 (4) female gametes that develop within ovaries

- 23 What usually results when an organism fails to maintain homeostasis?

- (1) Growth rates within organs become equal.
 (2) The organism becomes ill or may die.
 (3) A constant sugar supply for the cells is produced.
 (4) The water balance in the tissues of the organism stabilizes.

- 24 Which activity is *not* a response of human white blood cells to pathogens?

- (1) engulfing and destroying bacteria
 (2) producing antibodies
 (3) identifying invaders for destruction
 (4) removing carbon dioxide

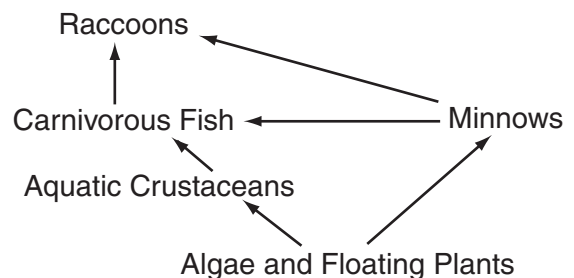
- 25 In some individuals, the immune system attacks substances such as grass pollen that are usually harmless, resulting in

- (1) an allergic reaction
 (2) a form of cancer
 (3) an insulin imbalance
 (4) a mutation

- 26 A characteristic shared by all enzymes, hormones, and antibodies is that their function is determined by the

- (1) shape of their molecules
 (2) DNA they contain
 (3) inorganic molecules they contain
 (4) organelles present in their structure

- 27 The diagram below shows the relationships between the organisms in and around a pond.



- One additional biotic factor needed to make this a stable ecosystem is the presence of

- (1) producers
 (2) herbivores
 (3) decomposers
 (4) consumers

- 28 What is the major environmental factor limiting the numbers of autotrophs at great depths in the ocean?

- (1) type of seafloor
 (2) amount of light
 (3) availability of minerals
 (4) absence of biotic factors

29 The diagram below shows a food chain.



If the population of bobcats decreases, what will most likely be the long-term effect on the rabbit population?

- (1) It will increase, only.
- (2) It will decrease, only.
- (3) It will increase and then decrease.
- (4) It will decrease and then increase.

30 An owl cannot entirely digest the animals upon which it preys. Therefore, each day it expels from its mouth a pellet composed of materials such as fur, bones, and cartilage. By examining owl pellets, ecologists are able to determine the

- (1) autotrophs that owls prefer
- (2) organisms that feed on owls
- (3) pathogens that affect owls
- (4) consumers that owls prefer

31 In some areas, foresters plant one tree for every tree they cut. This activity is an example of

- (1) lack of management of nonrenewable natural resources
- (2) a good conservation practice for renewable natural resources
- (3) a good conservation practice for nonrenewable natural resources
- (4) lack of concern for renewable natural resources

32 To minimize negative environmental impact, a community should

- (1) approve the weekly spraying of pesticides on the plants in a local park
- (2) grant a permit to a chemical manufacturing company to build a factory by one of its lakes, with no restrictions on waste disposal
- (3) make a decision about building a new road in a hiking area based only on the economic advantages
- (4) set policy after considering both the risks and benefits involved in building a toxic waste site within its boundaries

33 Deforestation would most immediately result in

- (1) the disappearance of native species
- (2) industrialization of an area
- (3) the depletion of the ozone shield
- (4) global warming

34 El Niño is a short-term climatic change that causes ocean waters to remain warm when they should normally be cool. The warmer temperatures disrupt food webs and alter weather patterns. Which occurrence would most likely result from these changes?

- (1) Some species would become extinct, and other species would evolve to take their place.
- (2) Some populations in affected areas would be reduced, while other populations would increase temporarily.
- (3) The flow of energy through the ecosystem would remain unchanged.
- (4) The genes of individual organisms would mutate to adapt to the new environmental conditions.

35 Toxic chemicals called PCBs, produced as a result of manufacturing processes, were dumped into the Hudson River. What was most likely a result of this action on fish in the Hudson River?

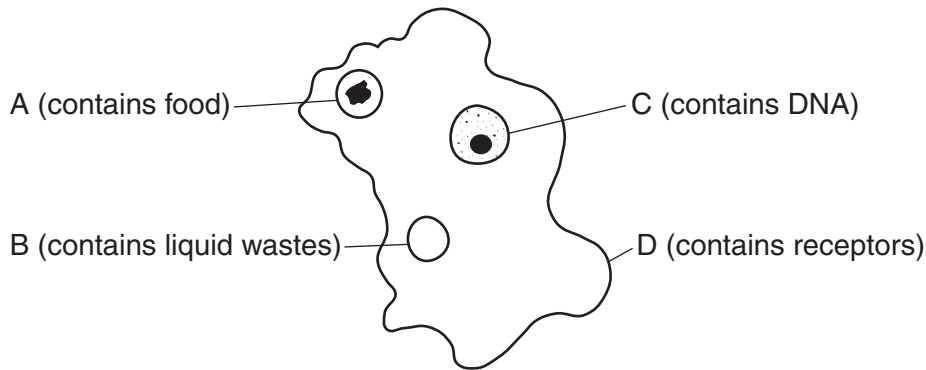
- (1) Some fish became unfit to eat.
- (2) The fish populations increased.
- (3) Thermal pollution of the river increased, decreasing the fish population.
- (4) The carrying capacity for fish increased in the river.

Part B

Answer all questions in this part

Directions (36–63): 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. [30].

Base your answers to questions 36 through 38 on the diagram below, which shows some of the specialized organelles in a single-celled organism, and on your knowledge of biology.



**For Teacher
Use Only**

36 Write the letter of *one* of the labeled organelles and state the name of that organelle. [1]

36

37 Explain how the function of the organelle you selected in question 36 assists in the maintenance of homeostasis. [1]

37

38 Identify a system in the human body that performs a function similar to that of the organelle you selected in question 36. [1]

38

Base your answers to questions 39 through 42 on the information and data table below and on your knowledge of biology.

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A student counted the total number of leaves in a group of duckweed plants (*Lemna gibba*) over a 5-day period. The data collected are shown in the table below.

Growth of Duckweed Leaves

Time in Days	Number of Leaves
0	15
1	20
2	25
3	40
4	60
5	80

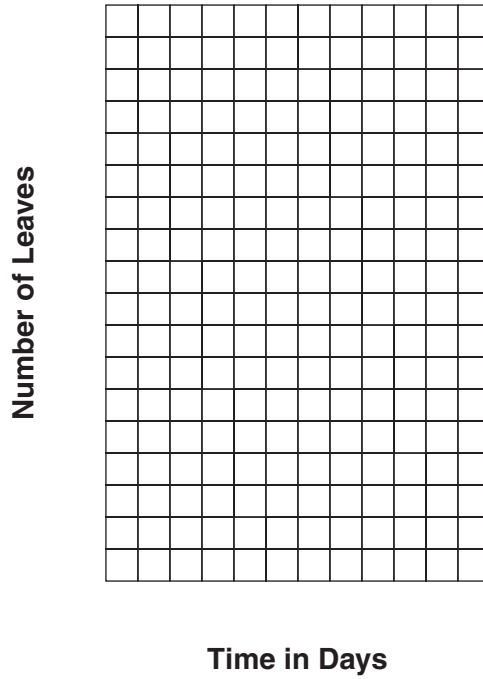
Directions (39–40): Using the information in the data table, construct a line graph on the grid provided on the next page following the directions below.

39 Mark an appropriate scale on each labeled axis. [1]

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



Growth of Duckweed Leaves



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39

40

41 The time it takes for the number of leaves to increase from 15 to 30 is approximately

- (1) 2.0 days
- (2) 2.3 days
- (3) 2.9 days
- (4) 3.2 days

41

42 State what would most likely happen to the production of oxygen by duckweed plants if the intensity and duration of exposure to light were increased. [1]

42

Base your answers to questions 43 through 47 on the passage below and on your knowledge of biology.

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Help Wanted — Bacteria for Environmental Cleanup

The location of a former fuel storage depot and packaging operation in the industrial port of Toronto, Canada, is the proposed site of a sports arena and entertainment complex. The problem is that the soil in this area was contaminated with gasoline, diesel fuel, home heating oil, and grease from the operation of the previous facility. Unless these substances are removed, the project cannot proceed.

The traditional method of cleaning up such sites is the “dig and dump” method, in which the contaminated soil is removed, deposited in landfills, and replaced with clean soil. This “dig and dump” method is messy and costly and adds to landfills that are already overloaded. A technique known as bio-remediation, which was used to help in the cleanup of the *Exxon Valdez* oil spill in Alaska, offered a relatively inexpensive way of dealing with this pollution problem. This cleanup process cost \$1.4 million, one-third of the cost of the “dig and dump” method, and involved encasing 85,000 tons of soil in a plastic “biocell” the size of a football field. This plastic-encased soil contained naturally occurring bacteria that would eventually have cleaned up the area after 50 years or more with the amounts of oxygen and nutrients naturally found in the soil. Air, water, and fertilizer were piped into the biocell, stimulating the bacteria to reproduce rapidly and speed up the process. The cleanup by this technique was begun in August and completed in November of the same year. The bacteria attack parts of the contaminating molecules by breaking the carbon-to-carbon bonds that hold them together. This helps to change these molecules in the soil into carbon dioxide and water.

Although this method is effective for cleaning up some forms of pollution, bio-remediation is not effective for inorganic materials such as lead or other heavy metals since these wastes are already in a base state that cannot be degraded any further.

43 The use of bio-remediation by humans is an example of

- (1) interfering with nature so that natural processes cannot take place
- (2) using a completely unnatural method to solve a problem
- (3) solving a problem by speeding up natural processes
- (4) being unaware of and not using natural processes

43

44 The bacteria convert the contaminants into

- (1) carbon dioxide and water
- (2) toxic substances
- (3) proteins and fats
- (4) diesel fuel and grease

44

45 State an ecological drawback to the use of the “dig and dump” method. [1]

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45

46 Explain why the cleanup took only 3 months. [1]

46

47 Bio-remediation is *not* an effective method for breaking down

- (1) grease
- (2) gasoline
- (3) fuel for diesel engines and furnaces
- (4) heavy metals such as lead

47

Base your answer to question 48 on the information and data table below and on your knowledge of biology.

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Two species of fish were subjected to a series of treatments. The number of red blood cells flowing per minute through one capillary in the tail of each fish was counted and the average calculated. The data table below shows the treatments given to each species of fish and the results of the various treatments.

Data Table

Treatment	Species of Fish	Number of Fish Used	Average Number of Red Blood Cells
Adrenaline added (1:10,000 solution)	Trout	10	35
Adrenaline added (1:1,000 solution)	Trout	10	50
50% alcohol solution added	Trout	5	78
Temperature reduced (25°C to 4°C)	Trout	6	30
Lactic acid added (1:5,000 solution)	Sunfish	6	90
25% alcohol solution added	Sunfish	6	89
Adrenaline added (1:10,000 solution)	Sunfish	6	17
Temperature reduced (25°C to 4°C)	Sunfish	6	14
Temperature increased (15°C to 25°C)	Sunfish	6	22

48 State *two* errors in this investigation. [2]

48

49 Meiosis occurs in the development of sex cells. Mitosis occurs in most other cells. Identify *two* additional differences between these processes. [2]

49

50 The chart below shows information about the relationship between the age of the mother and the occurrence of Down syndrome in the child.

Age of Mother	Occurrence of Down Syndrome per 1000 Births
25	0.8
30	1.0
35	3.0
40	10.0
45	30.0
50	80.0

State *one* conclusion that can be drawn from the chart concerning the relationship between the age of the mother and the chance of her having a child with Down syndrome. [1]

50

51 Using *one* specific example, identify *one* action taken by a mother that could have a negative effect on the embryonic development of her baby. [1]

51

52 In desert environments, organisms that cannot maintain a constant internal body temperature, such as snakes and lizards, rarely go out during the hot, sunny daylight hours. They stay in the shade, under rocks, or in burrows during the day. Explain how this behavior helps maintain homeostasis in these organisms. [1]

52

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Use Only**

53 In the early 1980s, scientists discovered holes in the ozone shield surrounding Earth. State *one* negative effect this environmental change could have on humans. [1]

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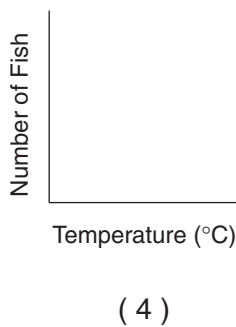
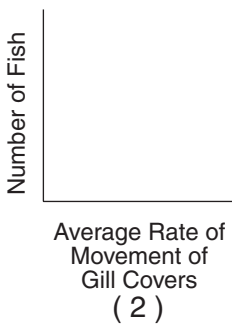
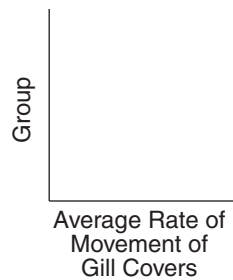
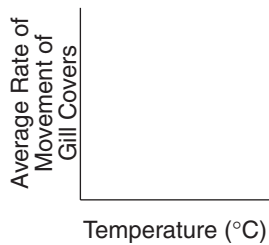
53

54 In an investigation, students determined the average rate of movement of gill covers of a species of freshwater fish at different temperatures. The results are shown in the data table below.

Data Table

Group	Number of Fish	Temperature (°C)	Average Rate of Movement of Gill Covers per Minute
1	5	10	15
2	6	15	25
3	4	18	30
4	7	20	38
5	6	23	60
6	4	25	57
7	4	27	25

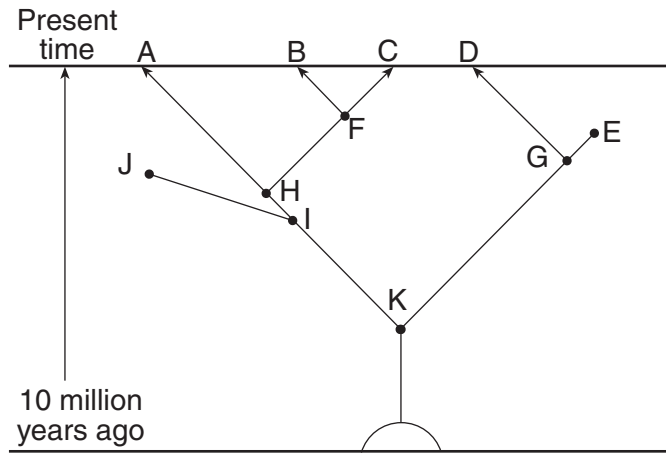
Which labeled axes should be used to graph the relationship between the two variables?



54

Base your answers to questions 55 through 57 on the diagram below and on your knowledge of biology. The diagram shows an interpretation of relationships based on evolutionary theory. The letters represent different species.

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55 Explain why species *B* and *C* are more closely related than species *A* and *C* are. [1]

55

56 The diagram indicates that a common ancestor for species *C* and *E* is species

- (1) *F*
- (2) *G*
- (3) *H*
- (4) *K*

56

57 Which species are *least* likely to be vital parts of a present-day ecosystem?

- (1) *A* and *E*
- (2) *C* and *D*
- (3) *E* and *J*
- (4) *B* and *F*

57

58 Hemoglobin is a complex protein molecule found in red blood cells. Hemoglobin with the normal sequence of amino acids is able to carry oxygen to body cells effectively. In the disorder known as sickle-cell anemia, one amino acid is substituted for another in the hemoglobin. One characteristic of this disorder is poor distribution of oxygen to the body cells. Explain how the change in amino acid sequence of this protein could cause the results described. [1]

58

59 Recently, scientists have been sent to rain forest areas by pharmaceutical and agricultural corporations to bring back samples of seeds, fruits, and leaves before these densely vegetated areas are destroyed. State *one* reason these corporations are interested in obtaining these samples. [1]

59

60 Two species of microorganisms were placed in the same culture dish, which included basic materials necessary for life. The size of each population increased during the first three days. After one week, the population size of one species began to decline each day. State *one* possible reason for this decline. [1]

60

61 State what could happen to a species in a changing environment if the members of that species do not express any genetic variations. [1]

61

62 In certain areas of the United States, the populations of wolves and other predators have decreased. As a result, deer populations in these areas have increased. Describe *one* way that an increase in the deer population can be harmful to humans. [1]

62

63 State *one* environmental impact of reduced funding for public transportation (trains, city buses, school buses, etc.) on future generations. Explain your answer. [1]

63

**Total Score
for Part B**

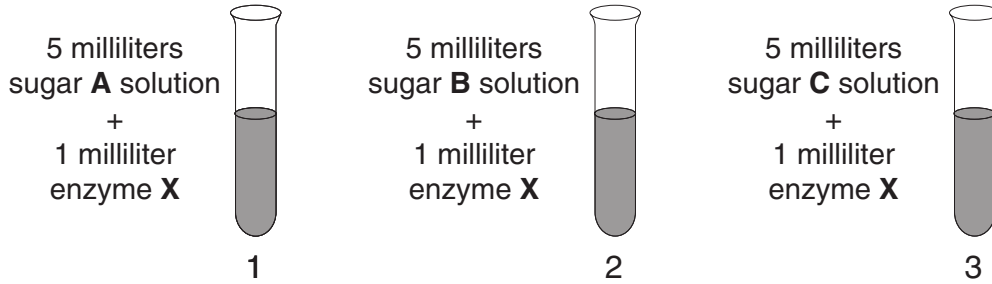
Part C

Answer all questions in Part C.

Directions (64–71): Record your answers in the spaces provided in this examination booklet.

Base your answers to questions 64 through 66 on the information below and on your knowledge of biology.

An investigation was performed to determine the effects of enzyme X on three different disaccharides (double sugars) at 37°C. Three test tubes were set up as shown in the diagram below.



At the end of 5 minutes, the solution in each test tube was tested for the presence of disaccharides (double sugars) and monosaccharides (simple sugars). The results of these tests are shown in the table below.

	Test Tube 1	Test Tube 2	Test Tube 3
Monosaccharide	not present	not present	present
Disaccharide	present	present	not present

64 What can be concluded about the activity of enzyme X from the data table? [1]

64

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65 With only the materials list supplied below and common laboratory equipment, design an investigation that would show how a change in pH would affect the activity of enzyme X. Your design need only include detailed procedure and a data table. [3]

Materials

- Enzyme X
- Sugar C solution
- Indicators
- Substances of various pH values —
 - vinegar (acidic)
 - water (neutral)
 - baking soda (basic)

Procedure:

Data Table:



66 State *one* safety precaution that should be used during the investigation. [1]

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66

67 For many years, humans have used a variety of techniques that have influenced the genetic makeup of organisms. These techniques have led to the production of new varieties of organisms that possess characteristics that are useful to humans. Identify *one* technique presently being used to alter the genetic makeup of an organism, and explain how humans can benefit from this change. Your answer must include at least:

- the name of the technique used to alter the genetic makeup [1]
- a brief description of what is involved in this technique [1]
- *one* specific example of how this technique has been used [1]
- a statement of how humans have benefited from the production of this new variety of organism [1]

67

68 All living organisms are dependent on a stable environment.

a Describe how humans have made the environment less stable by:

- changing the chemical composition of air, soil, and water [1]
- reducing the biodiversity of an area [1]
- introducing technologies [1]

b Describe *two* specific ways recently used by humans to reduce the amount of chemicals being added to the environment. [2]

68



69 A European species of rabbit was released on a ranch in Victoria, Australia. The species thrived and reproduced rapidly. The rabbits overgrazed the land, reducing the food supply for the sheep. The *Myxoma sp.* virus was used to kill the rabbits. The first time this virus was applied, it killed 99.8% of the rabbits. When the rabbits became a problem again, the virus was applied a second time. This time, only 90% of the rabbits were killed. When the rabbits became a problem a third time, the virus was applied once again, and only 50% of the rabbits were killed. Today, this virus has little or no effect on this species of rabbit.

Explain what happened to the species of rabbit as a result of the use of this virus. You must *include* and *circle* the following terms in your answer. [4]

- gene
- adaptive value *or* adaptation *or* adapted
- variation
- survival of the fittest

69



Base your answers to questions 70 and 71 on the information in the newspaper article below and on your knowledge of biology.

Patients to test tumor fighter

Boston—Endostatin, the highly publicized experimental cancer drug that wiped out tumors in mice and raised the hopes of cancer patients, will be tested on patients this year.

“I think it’s exciting, but ... you always have the risk that something will fail in testing,” said Dr. Judah Folkman, the Harvard University researcher whose assistant, Michael O’Reilly, discovered endostatin.

Endostatin and a sister protein, angiostatin, destroy the tumors’ ability to sprout new blood vessels. This makes cancer fall dormant in lab animals, but no one knows if that will happen in humans.

The Associated Press

70 Explain why it is necessary to test these experimental drugs on human volunteers as well as on test animals. [1]

70

71 State *one* reason that mice are often used by scientists for testing experimental drugs that may be used by humans. [1]

71

**Total Score
for Part C**

Tear Here

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Thursday, August 16, 2001 — 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)		<input type="text"/>
Final Score (from conversion chart)		<input type="text"/>
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

