

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

# LIVING ENVIRONMENT

Friday, June 16, 2000 — 1:15 to 4:15 p.m., only

The answer paper for Parts A and B is stapled in the center of this examination booklet. Open the examination booklet, carefully remove the answer paper, and close the examination booklet. Then fill in the heading on your answer paper.

Your answers to Parts A and B are to be recorded on the separate answer paper. Your answers to Part C are to be written on paper provided by the school. You are to answer all the questions in each part.

For each question in Part A and the multiple-choice questions in Part B, decide which of the choices given is the best answer. Then on the answer paper, in the row of numbers for that question, circle with pencil the number of the choice that you have selected. The sample below is an example of the first step in recording your answers.

SAMPLE:    ①   2   3   4

If you wish to change an answer, erase your first penciled circle and then circle with pencil the number of the answer you want. After you have completed all three parts of the examination and you have decided that all of the circled answers represent your best judgment, signal a proctor and turn in all examination material except your answer paper. Then and only then, place an X in ink in each penciled circle. Be sure to mark only one answer with an X in ink for each question. No credit will be given for any question with two or more X's marked. The sample below indicates how your final choice should be marked with an X in ink.

SAMPLE:    ⊗   2   3   4

For questions in Part B that are not multiple-choice questions and the questions in Part C, record your answers in accordance with the directions given in the examination booklet.

When you have completed the examination, you must sign the statement printed at the end of the answer paper, 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 paper 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, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer on the separate answer paper in accordance with the directions on the front page of this booklet.

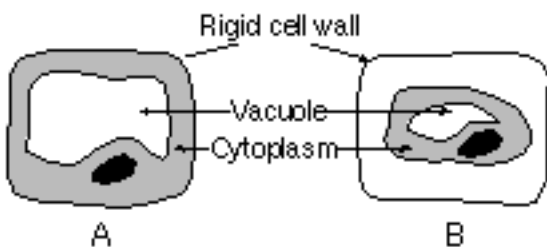
- 1 An experiment was performed to determine the effect of different mineral salts on plant growth. Forty pots containing genetically identical plants were divided into four equal groups and placed in a well-lighted greenhouse. Each pot contained an equal amount of nonmineral potting soil and one plant. Minerals were then added in equal amounts to each experimental group of pots as shown below.

Control Group	Experimental Groups		
			
	Water + Nitrogen salts	Water + Potassium salts	Water + Phosphorus salts

For the experiment to be valid, what should be added to the control group of pots?

- |                  |                                  |
|------------------|----------------------------------|
| 1 water          | 3 potassium salts                |
| 2 nitrogen salts | 4 potassium and phosphorus salts |

- 2 A biologist observed a plant cell in a drop of water as shown in diagram A. The biologist added a 10% salt solution to the slide and observed the cell as shown in diagram B.



The change in appearance of the cell resulted from

- 1 more salt moving out of the cell than into the cell
- 2 more salt moving into the cell than out of the cell
- 3 more water moving into the cell than out of the cell
- 4 more water moving out of the cell than into the cell

- 3 Which statement describing the cells in a body system is correct?

- 1 Each cell in the system is identical to the other cells in the system, and each cell works independently of the other cells.
- 2 Some cells in the system may be different from the other cells in the system, but all cells are coordinated and work together.
- 3 Each cell in the system is different from the other cells in the system, and each cell works independently of the other cells.
- 4 All cells in the system are identical to each other and work together.

- 4 The process of active transport requires the most direct use of

- |                    |             |
|--------------------|-------------|
| (1) carbon dioxide | (3) ATP     |
| (2) amino acids    | (4) glucose |

5 Which substances may form in the human body due to invaders entering the blood?

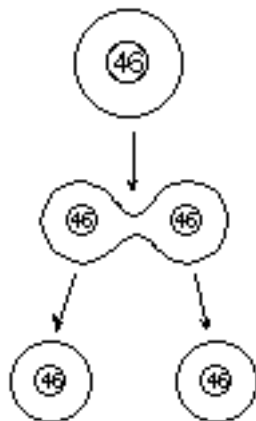
- 1 nutrients
- 2 vaccines
- 3 antibodies
- 4 red blood cells

6 To communicate between cells, many multi-cellular animals use

- 1 nerve signals and respiratory gases
- 2 respiratory gases and hormones
- 3 bones and muscles
- 4 nerve signals and hormones

7 The diagram to the right can be used to illustrate a process directly involved in

- 1 tissue repair
- 2 meiosis
- 3 recombination
- 4 sexual reproduction



8 The function of the coded instructions contained in the body cells of an organism is to

- 1 form a variety of gametes that will pass on hereditary information
- 2 direct the synthesis of proteins necessary for proper cell function
- 3 synthesize different kinds of amino acids in a specific sequence
- 4 produce the inorganic molecules needed for normal cell growth

9 Which characteristic allows enzymes to function in a specific way?

- 1 Enzymes are complex compounds composed of starch.
- 2 Each enzyme has a characteristic shape.
- 3 Enzymes are long, complex fats.
- 4 Each enzyme is made up of four subunits.

10 Flower color in primrose plants is controlled by an individual gene. The sudden appearance of one white flowering primrose in a plant breeder's field of red primrose plants is most likely due to

- 1 a change in the amount of glucose produced during photosynthesis
- 2 the use of a new natural fertilizer on the field
- 3 rapid mitotic divisions within the developing seeds
- 4 a random change in the structure of DNA during meiosis

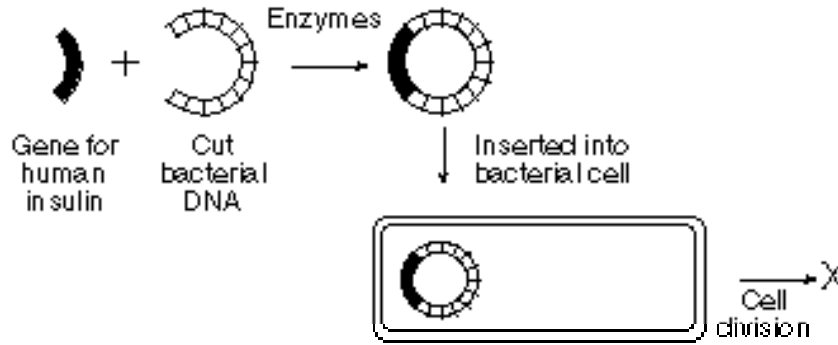
11 White short-horned cattle and Black Angus cattle have been crossed to produce offspring with superior beef and rapid growth qualities. This process of choosing organisms with the most desirable traits for mating is known as

- 1 cloning
- 2 biodiversity
- 3 selective breeding
- 4 genetic engineering

12 When the antibiotic penicillin was first introduced, it was immediately effective in combating staphylococcus bacterial infections. After a number of years, there were outbreaks of staphylococcal infections that did not respond to treatment with penicillin. The best explanation for this situation is that

- 1 members of the original population of bacteria that were penicillin resistant survived and reproduced, creating a more resistant population
- 2 the bacteria that survived exposure to penicillin learned to avoid it
- 3 the bacteria that caused the new outbreaks were from populations that had never been exposed to penicillin
- 4 during each generation, the bacteria modified their own DNA to increase their ability to resist penicillin and passed this ability on to their descendants

13 The diagram below illustrates some key steps of a procedure in one area of biotechnology.



The letter X most likely represents

- 1 bacterial cells that are unable to synthesize insulin
- 2 human cells that are able to synthesize antibodies
- 3 bacterial cells that are able to synthesize insulin
- 4 human cells that are unable to resist antibiotics

14 Which statement about the rates of evolution for different species is in agreement with the theory of evolution?

- 1 They are identical, since the species live on the same planet.
- 2 They are identical, since each species is at risk of becoming extinct.
- 3 They are different, since each species has different adaptations that function within a changing environment.
- 4 They are different, since each species has access to unlimited resources within its environment.

15 Which concept is not a part of the theory of evolution?

- 1 Present-day species developed from earlier species.
- 2 Some species die out when environmental changes occur.
- 3 Complex organisms develop from simple organisms over time.
- 4 Change occurs according to the needs of an individual organism to survive.

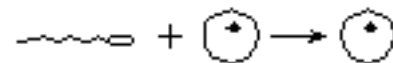
16 Warts result when certain viruses cause skin cells to reproduce at a high rate. This rapid reproduction of skin cells is due to the viruses stimulating

- |                         |                         |
|-------------------------|-------------------------|
| 1 cellular digestion    | 3 synthesis processes   |
| 2 mitotic cell division | 4 meiotic cell division |

17 Even though the environment changes, a population that occupies a given geographic area will most likely continue to be found in this area if the

- 1 variations in the population decrease over time
- 2 members of the population decrease in number
- 3 members of the population exceed the carrying capacity
- 4 population passes on those genes that result in favorable adaptations

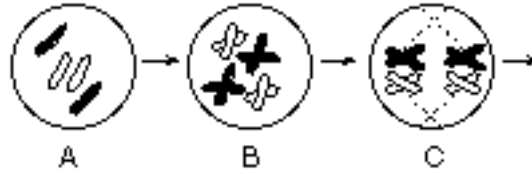
18 The diagram below represents a reproductive process that takes place in humans.



Which statement does *not* correctly describe this process?

- 1 The normal species chromosome number is restored.
- 2 Males and females each contribute DNA to the offspring.
- 3 The zygote will develop to become identical to the dominant parent.
- 4 The sex of the zygote is determined by DNA in the gametes.

19 The diagrams below represent some events in a cell undergoing normal meiotic cell division.



Which diagram most likely represents a new cell resulting from meiotic cell division of the cell shown above?



20 When a pregnant woman ingests toxins such as alcohol and nicotine, the embryo is put at risk because these toxins can

- 1 diffuse from the mother's blood into the embryo's blood within the placenta
- 2 enter the embryo when it eats
- 3 transfer to the embryo since the mother's blood normally mixes with the embryo's blood in the placenta
- 4 enter the uterus through the mother's navel

21 The energy found in ATP molecules synthesized in animal cells comes directly from

- 1 sunlight
- 2 organic molecules
- 3 minerals
- 4 inorganic molecules

22 Which substances are necessary for the synthesis of most materials in an organism?

- |                 |              |
|-----------------|--------------|
| 1 hormones      | 3 antibodies |
| 2 carbohydrates | 4 enzymes    |

23 A certain mutant bacterial cell cannot produce substance X. The mutation was most likely the result of a change in the

- 1 structure of the cell membrane
- 2 ability of the DNA to replicate
- 3 amino acid sequence of DNA
- 4 gene that codes for a specific protein

24 Which statement best describes an immune response?

- 1 It always produces antibiotics.
- 2 It usually involves the recognition and destruction of pathogens.
- 3 It stimulates asexual reproduction and resistance in pathogens.
- 4 It releases red blood cells that destroy parasites.

25 Which statement describes a feedback mechanism involving the human pancreas?

- 1 The production of estrogen stimulates the formation of gametes for sexual reproduction.
- 2 The level of oxygen in the blood is related to heart rate.
- 3 The level of sugar in the blood is affected by the amount of insulin in the blood.
- 4 The production of urine allows for excretion of cell waste.

26 A green plant is kept in a brightly lighted area for 48 hours. What will most likely occur if the light intensity is reduced slightly during the next 48 hours?

- 1 Photosynthesis will stop completely.
- 2 The rate at which nitrogen is used by the plant will increase.
- 3 The rate at which oxygen is released from the plant will decrease.
- 4 Glucose production inside each plant cell will increase.

- 27 Which sequence shows a correct pathway for the flow of energy in a food chain?
- 1 bacteria Æ grass Æ fox Æ owl
  - 2 grass Æ grasshopper Æ frog Æ snake
  - 3 fungi Æ beetle Æ algae Æ mouse
  - 4 algae Æ snake Æ duck Æ deer
- 28 Before it was banned, the insecticide DDT was used to combat an organism called the red mite. An unexpected result of the use of DDT was that the population of the red mite increased rather than decreased, while the population of insect predators of the red mite decreased. What can be inferred from this situation?
- 1 Environmental changes that affect one population can affect other populations.
  - 2 The red mite and its insect predators were all competing for the same resources.
  - 3 The red mites were immune to the effects of insecticides.
  - 4 Using insecticides is a reliable way to eliminate all insect predators.
- 29 Chittenango Falls State Park in central New York State is the only known habitat for an endangered species of aquatic snail. Contamination of its water supply and reduction of its habitat have threatened the future of this snail. Which step could be taken to protect this species of snail?
- 1 banning human activities that damaged the habitat
  - 2 introducing a new snail predator into the habitat
  - 3 transferring the snail to a terrestrial environment
  - 4 crossbreeding the snail with another species
- 30 When humans use more ground water for industry than is being replaced, the soil above the ground water may collapse and disrupt natural habitats. This human activity is an example of
- 1 species exploitation
  - 2 renewal of natural resources
  - 3 a disposal problem
  - 4 poor use of finite resources
- 31 Decomposition and decay of organic matter are accomplished by the action of
- 1 green plants
  - 2 bacteria and fungi
  - 3 viruses and algae
  - 4 scavengers
- 32 For many decades, certain areas of New York State have remained as hardwood forests containing predominantly oak and hickory trees. These forested areas will most likely
- 1 remain indefinitely and not be affected by environmental influences
  - 2 reach maturity and change in the near future
  - 3 be destroyed by environmental changes and never return to their present forms
  - 4 continue in their present forms unless affected by environmental factors
- 33 What is a characteristic of a stable environment?
- 1 It usually contains only one type of producer.
  - 2 It usually contains a great diversity of species.
  - 3 It contains simple food chains that have more consumers than producers.
  - 4 It contains complex food webs that have more heterotrophs than autotrophs.
- 34 Which human activity has probably contributed most to the acidification of lakes in the Adirondack region?
- 1 passing environmental protection laws
  - 2 establishing reforestation projects in lumbered areas
  - 3 burning fossil fuels that produce air pollutants containing sulfur and nitrogen
  - 4 using pesticides for the control of insects that feed on trees
- 35 To ensure environmental quality for the future, each individual should
- 1 acquire and apply knowledge of ecological principles
  - 2 continue to take part in deforestation
  - 3 use Earth's finite resources
  - 4 add and take away organisms from ecosystems

**Part B**

**Answer all 27 questions in this part.** [30]

**For those questions that are followed by four choices, record the answers on the separate answer paper in accordance with the directions on the front page of this booklet. For all other questions in this part, record your answers in accordance with the directions given in the question.**

Base your answers to questions 36 through 38 on the information and data table below and on your knowledge of biology.

In an investigation, three seeds of the same species were allowed to germinate and grow in three different locations. Each seedling was grown in the same amount and type of soil, and each received the same amount of water during a 6-day period. At the end of the investigation, the height of each seedling and the color of its leaves were recorded. The results are shown in the data table to the right.

Data Table		
Location	Height (cm)	Leaf Color
Sunny windowsill	7	green
Indirect sunlight	9	green
Closed closet	11	whitish yellow

36 Which hypothesis was most likely being tested in this investigation?

- 1 A plant grown in the dark will not be green.
- 2 The type of soil a plant is grown in influences how tall it will be.
- 3 Plants need water to grow.
- 4 Plants grown in red light are taller than plants grown in green light.

37 State *two* ways that this investigation could be modified to lead to a more reliable conclusion. [2]

38 Which statement correctly explains why chlorophyll production *decreased* in the seedlings kept in the closet?

- 1 Lack of sunlight altered the expression of the gene for chlorophyll production.
- 2 The enzymes involved in chlorophyll production mutate in cooler temperatures.
- 3 Chloroplasts migrate to the center of the cell when light is not available.
- 4 Chlorophyll is converted to another pigment when light is not present.

39 A coverslip should be used for preparing a

- 1 frog for dissection
- 2 solution of iodine for food testing
- 3 wet mount of elodea (a simple plant)
- 4 test to determine the pH of a solution

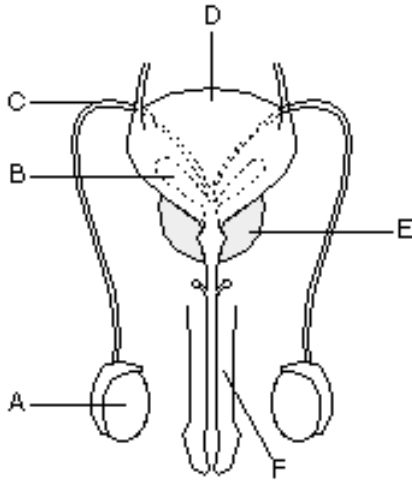
40 A sample of food containing one type of a large molecule was treated with a specific digestive enzyme. Nutrient tests performed on the resulting products showed the presence of simple sugars, only. Based on these test results, the original large molecules contained in the sample were molecules of

- (1) protein
- (2) glucose
- (3) starch
- (4) DNA

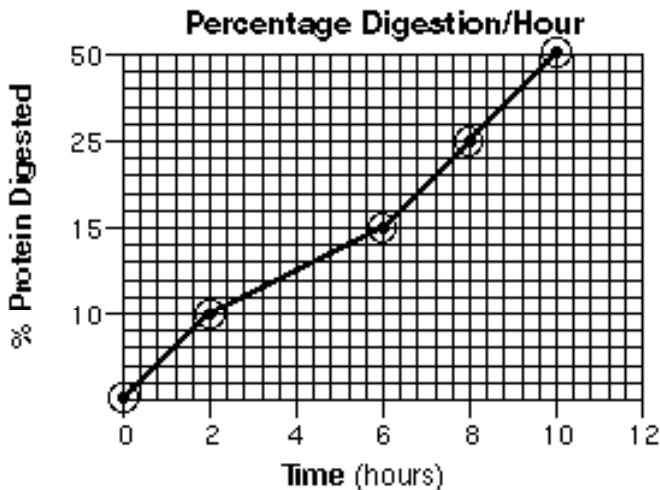
41 A television commercial for a weight-loss pill claims that it has been “scientifically tested.” The advertisement includes statements from 10 people who say that the pill worked for them. State *two* reasons why someone should question the claims made in this advertisement. [2]

42 When HIV, which causes AIDS, invades the body of a person, that person often develops diseases. These diseases are caused by organisms that usually do not harm people who are not infected with HIV. Explain why the organisms are more harmful to people with HIV than to people without HIV. [1]

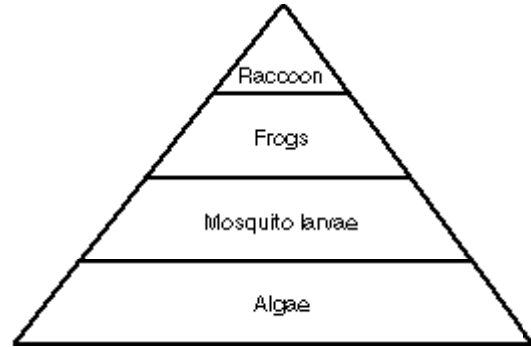
Base your answers to questions 43 through 45 on the diagram below and on your knowledge of biology.



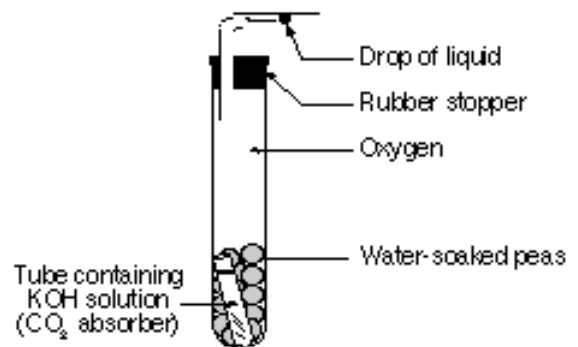
- 43 Which letter indicates a structure that secretes a hormone that promotes maturation of gametes? [1]
- 44 Which letter indicates a structure that is *not* involved in the production or delivery of gametes? [1]
- 45 Structures *B* and *E* provide nutrients and fluid for the gametes. Why are these substances necessary for fertilization? [1]
- 46 Describe *one* error that was made in the preparation of the graph shown below. [1]



Base your answers to questions 47 through 49 on the diagram below and on your knowledge of biology.



- 47 State *one* reason that algae form the base of this pyramid. [1]
- 48 Which term best describes the mosquito larvae?  
 1 producer                      3 carnivore  
 2 parasite                        4 consumer
- 49 Explain why each level of the pyramid *decreases* in area from bottom to top. [1]
- 50 Describe the role of scavengers in an ecosystem. [1]
- 51 Explain how carbohydrates provide energy for life functions. [1]
- 52 In the demonstration shown below, which process performed by the peas when they start to grow causes the drop of liquid to move to the left?



- 1 protein synthesis              3 digestion  
 2 photosynthesis                4 cellular respiration



Base your answers to questions 53 through 56 on the information below and on your knowledge of biology.

### Organ Transplants of the Future

While most people take good health for granted, thousands of others desperately need to replace a failing organ with one that is healthy. Most healthy organs come from people who agreed to donate them upon their death, although it is possible to remove some tissue and organs (such as kidneys and bone marrow) from living donors. Unfortunately, organs for transplant are in short supply. As of 1992, over 22,000 Americans were waiting for a transplant.

Although increasingly common, transplants are risky procedures. During the operation, veins and arteries must be blocked to prevent blood loss. This deprives parts of the body of oxygen and nutrients and may result in permanent damage. In addition, the body may recognize the transplanted organ as foreign and mount an immune response in which specialized white blood cells (T-cells) attack the transplanted organ.

Drugs called immunosuppressants are given to transplant patients to prevent their immune system from rejecting the transplanted organ. However, these drugs weaken the ability of the body to fight disease and leave the patient less able to fight infection.

Scientists are exploring new technology for producing transplant tissues and organs. Unspecialized cells called stem cells are removed from the patient and then grown in a laboratory. Treating stem cells with the appropriate chemicals causes them to differentiate into various specialized tissues. In the future, scientists hope to develop chemical treatments that will cause stem cells to grow into complete organs needed for transplants. Transplants produced by this process would not be foreign material and, therefore, would not be rejected by the immune system of the patient.

- 53 Explain why a transplant might be dangerous to the health of a patient. [1]
- 54 State *one* reason that transplant patients might take an immunosuppressant drug. [1]
- 55 State *one* specific *disadvantage* of taking an immunosuppressant drug. [1]
- 56 Explain why doctors would consider using tissues or organs that have been grown from stem cells. [1]

---

Base your answers to questions 57 and 58 on the information below and on your knowledge of biology.

Before the Industrial Revolution, a light-colored variety of peppered moth was well camouflaged among light-colored lichens that grew on the bark of trees around London. A dark-colored variety of the peppered moth probably existed but was rarely observed because it was so easily seen by birds and eaten. When industry was introduced in London, soot killed the pollution-sensitive lichens, exposing dark tree bark. As a result, the dark-colored variety of the moth became the better camouflaged of the two moth varieties.

- |   |   |
|---|---|
| 57 In this situation, what is the relationship between the birds and the moths?<br>1 producer-consumer<br>2 predator-prey<br>3 parasite-host<br>4 autotroph-heterotroph | 58 Identify <i>one</i> way in which humans influenced the change in the populations of the peppered moth. [1] |
|---|---|

Base your answers to questions 59 through 62 on the information and data table below and on your knowledge of biology.

A student studied the effect of gibberellin (a plant hormone) on the growth of corn seedlings of the same height and species. A different concentration of gibberellin in a fixed volume of water was applied to 7 groups of 10 plants each maintained under the same environmental conditions for the duration of the experiment. At the end of this period, the height of each plant was measured. The data are shown in the table at the right.

**Data Table**

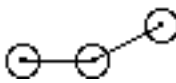
Micrograms of Gibberellin in a Water Solution	Average Height (cm)
0.00	20
0.05	40
0.10	60
0.25	70
0.50	75
1.00	80
2.00	80

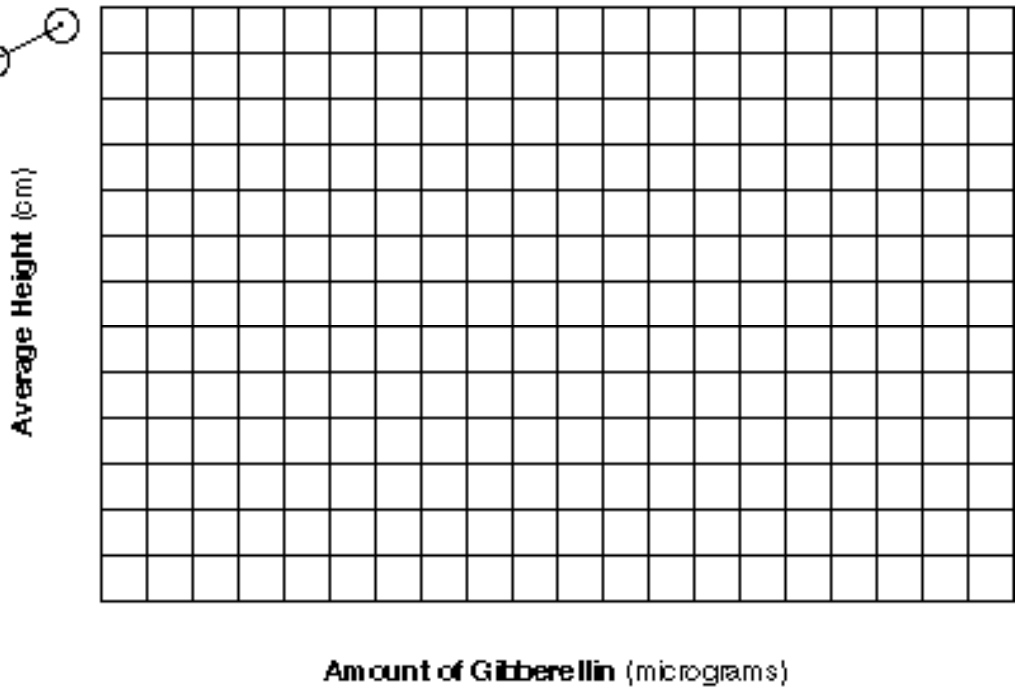
*Directions (59–61):* Using the information in the data table, construct a line graph on the grid provided on your answer paper, following the directions below. The grid below is provided for practice purposes only. Be sure your final answer appears on your answer paper.

59 Write an appropriate title for this graph in the space provided. [1]

60 Mark an appropriate scale on each labeled axis. [2]

61 Plot the data on the grid. Surround each point with a small circle and connect the points. [1]

Example: 



62 Explain the effect on corn seedling height of increasing the application amount of gibberellin from 0.05 to 0.50 microgram. [1]

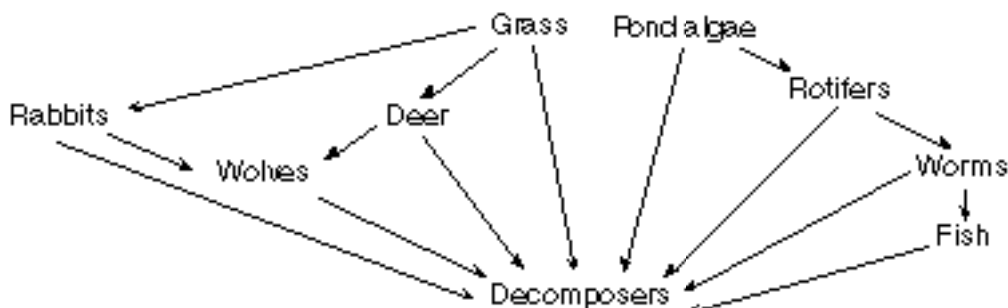
---

### Part C

Answer all 7 questions in this part. [20]

Answers to the following questions are to be written on paper provided by the school.

63 The food web below shows some of the relationships that exist between organisms in a field and pond ecosystem.



- a Write one or more paragraphs describing some of the relationships in this food web. In your answer, be sure to:
- identify a carnivore from the food web [1]
  - describe the complete path of energy from the Sun to that carnivore [1]
  - explain why decomposers are necessary in this food web [1]
- b A significant decrease in the wolf population occurs. After a period of one year, what change in the grass population would most likely be observed? [1]
- c A farmer sprayed pesticides on a field next to the pond. Using one or more complete sentences, explain why several years later the fish population would contain higher pesticide levels than any other pond organisms would contain. [1]

64 All living things carry out a variety of life functions such as coordination, excretion, digestion, circulation, and synthesis. Select *two* of the life functions listed. Define the two life functions you selected and explain how they interact to keep an organism alive. [4]

65 When Charles Darwin was developing his theory of evolution, he considered variations in a population important. However, he could not explain how the variations occurred. Name *two* processes that can result in variation in a population. Explain how these processes actually cause variation. [4]

66 Write one or more paragraphs that compare the two methods of reproduction, asexual and sexual. Your answer must include at least:

- *one* similarity between the two methods [1]
- *one* difference between the two methods [1]
- *one* example of an organism that reproduces by asexual reproduction [1]
- *one* example of an organism that reproduces by sexual reproduction [1]

GO RIGHT ON TO THE NEXT PAGE. ➡

Base your answers to questions 67 through 69 on the information below.

In a rural area, there is a swamp with a large population of mosquitos. Nearby residents are concerned because the mosquitos are always annoying and occasionally carry diseases. The community decides to have an insecticide sprayed from an airplane on the area during the prime mosquito season. Whenever they stop spraying, the mosquito population quickly rebounds to a higher level than existed before the spraying program began. After 10 years, the spraying became much less effective at reducing the mosquito population. Higher doses of insecticide were required to accomplish the same population decreases.

67 State *one* possible *disadvantage* of spraying the insecticide from an airplane. [1]

68 State *one* alternative method of mosquito control that may have a more lasting impact on the mosquito population. [1]

69 Give *one* positive effect or *one* negative effect, other than killing mosquitos, of the alternative method of mosquito control you stated in question 68. [1]

---

The University of the State of New York

REGENTS HIGH SCHOOL EXAMINATION

LIVING ENVIRONMENT

Friday, June 16, 2000 — 1:15 to 4:15 p.m., only

ANSWER PAPER

<b>Part A Score</b> (max 35 credits)	.....	.....
<b>Part B Score</b> (max 30 credits)	.....	.....
<b>Part C Score</b> (max 20 credits)	.....	.....
<b>Part D Score</b> (max 15 credits)	.....	.....
<b>Total (Official Regents)</b> <b>Examination Mark</b>	.....	.....
<b>Reviewer's Initials:</b>	_____	

Student ..... Sex:  Male  Female

Teacher ..... School .....

Record your answers on this answer paper in accordance with the instructions on the front cover of the test booklet.

Part A (35 credits)
Answer all questions in Part A.

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

**Part B**

**Answer all questions in Part B.**

**36** 1 2 3 4

**37**

---

---

---

---

**38** 1 2 3 4

**39** 1 2 3 4

**40** 1 2 3 4

**41**

---

---

---

---

**42**

---

---

**43**

---

**44**

---

**45**

---

---

**46**

---

---

47

---

---

48 1 2 3 4

49

---

---

50

---

---

51

---

---

52 1 2 3 4

53

---

---

54

---

---

55

---

---

56

---

---

57 1 2 3 4

58

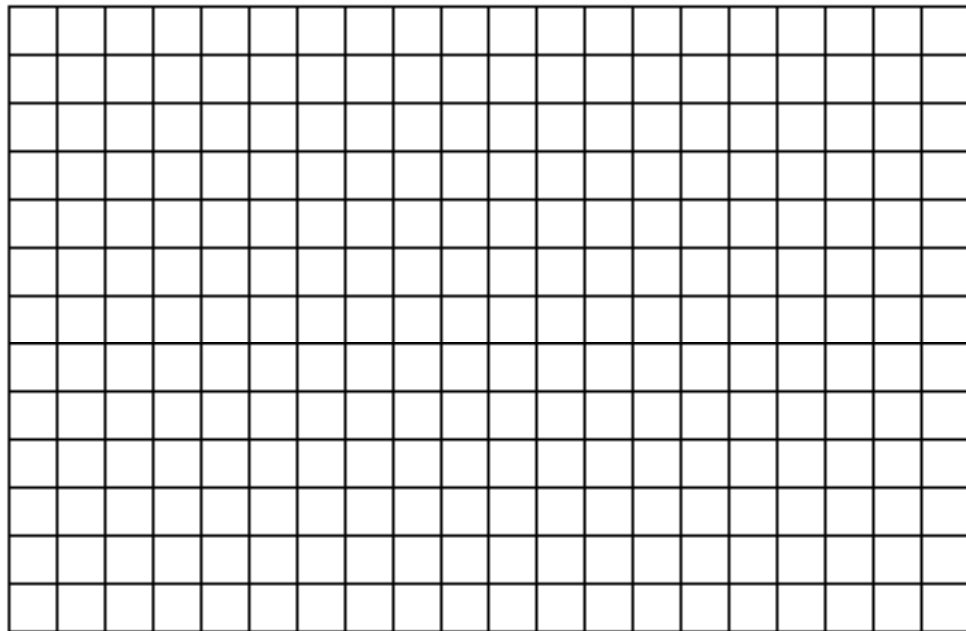
---

---

59 \_\_\_\_\_  
\_\_\_\_\_

60–61

Average Height (cm)



Amount of Gibberellin (micrograms)

62 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Note: Answers to Part C are to be written on separate answer paper provided by the school.**

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