

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

BIOLOGY

Friday, June 19, 1998 — 9:15 a.m. to 12:15 p.m., only

The answer paper 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.

All of your answers are to be recorded on the separate answer paper. For each question in Part I and Part II and the multiple-choice questions in Part III, 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 III that are not multiple-choice questions, 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.

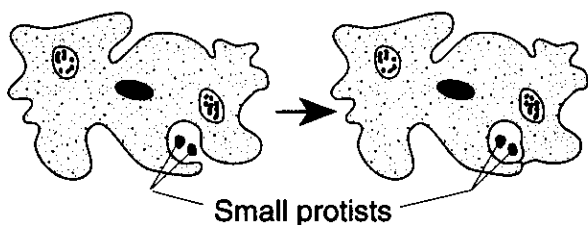
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

Part I

Answer all 59 questions in this part. [65]

Directions (1–59): 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 Which activity is illustrated in the diagram of an amoeba shown below?

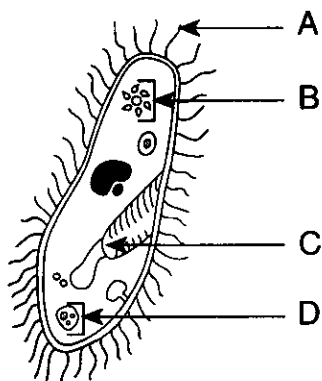


- 1 egestion
- 2 synthesis
- 3 respiration
- 4 ingestion

2 During a race, the body temperature of a runner increases. The runner responds by perspiring, which lowers body temperature. This process is an example of

- 1 maintenance of homeostasis
- 2 an antigen-antibody reaction
- 3 an acquired characteristic
- 4 environmental factors affecting phenotype

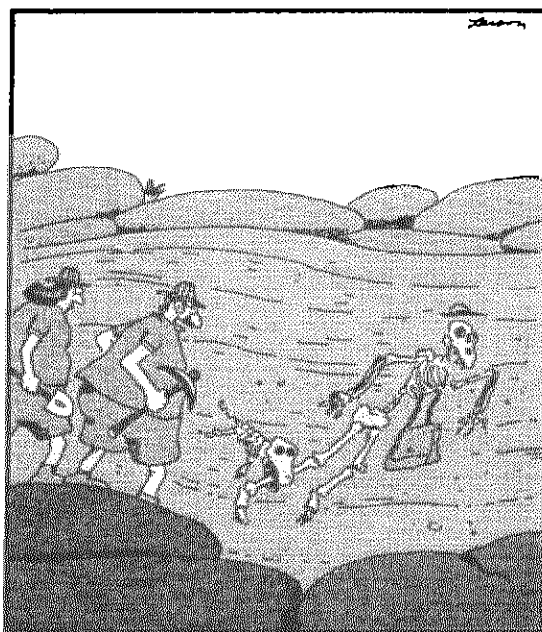
3 The diagram below represents a freshwater protist.



Which letter indicates a structure that prevents the accumulation of excess water in the protist?

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

4 In the cartoon below, *Canus nipponicus* refers to a proposed scientific name for an imaginary organism.



"What a find, Ms. Dinkins! ... It's Mailman, all right—but remarkably, this specimen is fully intact, with the *Canus nipponicus* still attached."

This proposed scientific name indicates the

- 1 kingdom and phylum
- 2 phylum and genus
- 3 genus and species
- 4 kingdom and species

5 Viruses are exceptions to the cell theory, but they have some characteristics of living things. What is one of these characteristics?

- 1 They are made up of many specialized cells.
- 2 They contain genetic material.
- 3 They reproduce by mitosis.
- 4 They contain chlorophyll.

6 Which formula represents an organic compound?

- (1) $Mg(OH)_2$
- (2) $NaCl$
- (3) $C_{12}H_{22}O_{11}$
- (4) NH_3

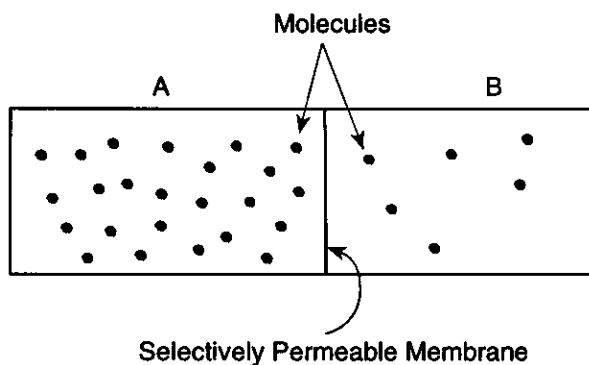
- 7 Hydrogen peroxide (H_2O_2) is a toxic by-product of cellular metabolism in aerobic organisms. The reaction below occurs within the cells to prevent the accumulation of hydrogen peroxide.



In this reaction, catalase functions as an

- 1 enzyme in the breakdown of hydrogen peroxide
 - 2 enzyme in the synthesis of hydrogen peroxide
 - 3 emulsifier in the digestion of hydrogen peroxide
 - 4 indicator in the detection of hydrogen peroxide
- 8 Which life process is classified as autotrophic in some organisms and heterotrophic in other organisms?
- 1 hormonal regulation
 - 2 nutrition
 - 3 anaerobic respiration
 - 4 transport
- 9 What does the process of photosynthesis produce?
- 1 starch, which is metabolized into less complex molecules by dehydration synthesis
 - 2 protein, which is metabolized into less complex molecules by dehydration synthesis
 - 3 glycerol, which is metabolized into more complex carbohydrates by dehydration synthesis
 - 4 glucose, which is metabolized into more complex carbohydrates by dehydration synthesis

- 10 The diagram below shows the same type of molecules in area A and area B. With the passage of time, some molecules move from area A to area B.



This movement is the result of the process of

- 1 phagocytosis
- 2 pinocytosis
- 3 diffusion
- 4 cyclosis

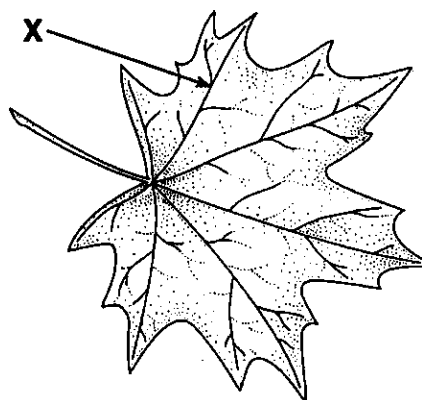
- 11 Which statement correctly describes one characteristic of the tubelike digestive system of an earthworm?

- 1 Various parts of the system perform different digestive functions.
- 2 The shape of the system allows food to be processed by intracellular digestion.
- 3 The shape of the system eliminates the need for egestion.
- 4 Digestive enzymes are not used in the system.

- 12 The absorption and circulation of materials in a hydra are most similar to the absorption and circulation of materials in a

- | | |
|---------------|---------|
| 1 grasshopper | 3 human |
| 2 protozoan | 4 frog |

- 13 What are the primary components of the structure labeled X in the diagram below?



- 1 stomates and lenticels
- 2 xylem tissue and phloem tissue
- 3 epidermal cells and guard cells
- 4 cambium and root hairs

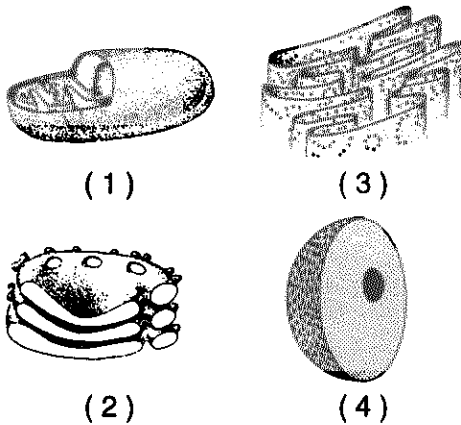
- 14 The fermentation of glucose by yeast normally yields

- (1) lactic acid, CO_2 , and 2 ATP
- (2) alcohol, CO_2 , and 36 ATP
- (3) alcohol, CO_2 , and 2 ATP
- (4) CO_2 , H_2O , and 36 ATP

- 15 Which waste product of a grasshopper may be retained and used in other metabolic activities?

- | | |
|-------------|------------------|
| 1 water | 3 carbon dioxide |
| 2 uric acid | 4 feces |

16 Which diagram represents an organelle that contains the enzymes needed to synthesize ATP in the presence of oxygen?



17 Which title is an appropriate heading for column X?

Organism	X
A	Moist skin
B	Spiracles and tracheal tubes
C	Gills and capillaries

- 1 Structures Needed for Anaerobic Respiration
- 2 Structures Used in Gas Exchange
- 3 Excretory Systems
- 4 Sensory Receptors

18 Which organism is correctly paired with the excretory adaptation used for the removal of its nitrogenous wastes?

- 1 grasshopper — nephron
- 2 human — Malpighian tubules
- 3 hydra — kidney
- 4 earthworm — nephridia

19 Which substances are secreted at the endings of nerve cells?

- | | |
|--------------|---------------------|
| 1 antibodies | 3 neurotransmitters |
| 2 antigens | 4 lipids |

20 A drastic change in the metabolic rate of a human would most likely result from the

- 1 oversecretion of the salivary glands
- 2 overproduction of auxins
- 3 deterioration of the skeletal system
- 4 malfunction of the endocrine glands

21 Which set of terms would most likely be used in a description of the nervous system of chordates?

- 1 brain, dorsal nerve cord, highly developed receptors
- 2 brain, fused ganglia, ventral nerve cord
- 3 no brain, fused ganglia, tympana
- 4 no brain, nerve net, modified neurons

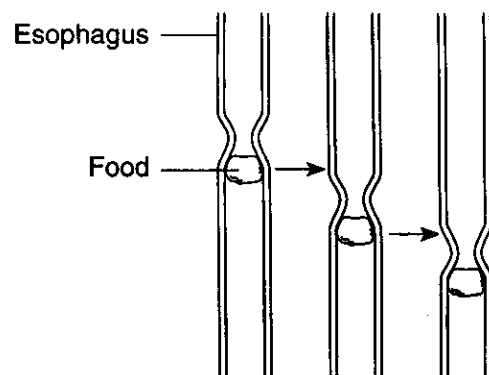
22 Three organisms possess some of the characteristics shown in the chart below. An X indicates that the characteristic is present.

Organism	Consumer	Structures for Locomotion		
		Cilia	Flagella	Pseudopods
A			X	
B	X			X
C	X	X		

Which statement best describes these organisms?

- (1) A could be an alga, B could be an ameba, and C could be a paramecium.
- (2) A could be a plant, and B and C could be coelenterates.
- (3) A could be a yeast, and B and C could be bacteria.
- (4) A could be a moss, B could be a hydra, and C could be an earthworm.

23 The diagram below shows a particle of food being moved along the human digestive tract by alternate waves of relaxation and contraction of the muscular walls of the esophagus.



Which process causes the movement of the food down the esophagus?

- | | |
|--------------------|---------------|
| 1 circulation | 3 peristalsis |
| 2 active transport | 4 osmosis |

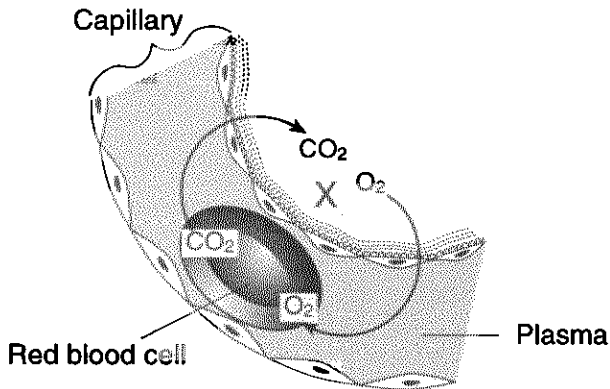
24 A malfunction of the lymph nodes would most likely interfere with the

- 1 release of carbon dioxide into the lymph
- 2 filtering of glucose from the lymph
- 3 release of oxygen into the lymph
- 4 filtering of bacteria from the lymph

25 A pulse can be detected most easily in

- 1 an artery
- 2 a vein
- 3 a capillary
- 4 a lacteal

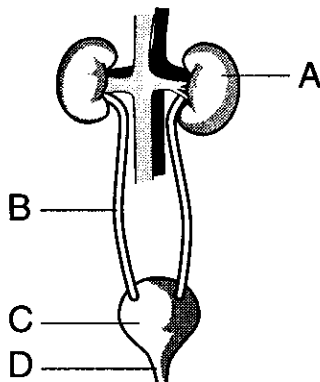
26 The diagram below represents part of a capillary in a specific region of the human body.



The region labeled X represents part of

- 1 a glomerulus
- 2 an alveolus
- 3 a villus
- 4 the liver

27 The diagram below represents a group of organs in the human body.



Urine leaves the urinary bladder by passing through structure

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

28 Which row in the chart below contains the words that best complete this statement?

The I glands produce II, which are transported by the III system.

Row	I	II	III
A	digestive	hormones	circulatory
B	endocrine	enzymes	lymphatic
C	endocrine	hormones	circulatory
D	digestive	enzymes	lymphatic

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

29 One function of the human endoskeleton is to

- 1 transmit impulses
- 2 produce blood cells
- 3 produce lactic acid
- 4 store nitrogenous wastes

30 What would most likely result if mitosis was *not* accompanied by cytoplasmic division?

- 1 two cells, each with one nucleus
- 2 two cells, each without a nucleus
- 3 one cell with two identical nuclei
- 4 one cell without a nucleus

31 Which structures are *not* involved in asexual reproduction?

- 1 centromeres
- 2 spindles
- 3 chromosomes
- 4 setae

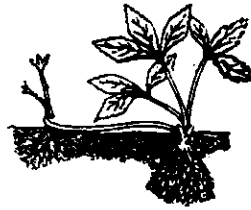
32 Which statement best explains why invertebrates regenerate lost tissue more readily than most vertebrates do?

- 1 Invertebrates contain specialized cells that produce the hormones necessary for this process.
- 2 Invertebrate cells exhibit a higher degree of uncontrolled cell division than vertebrate cells do.
- 3 Invertebrate animals reproduce asexually, but vertebrate animals reproduce sexually.
- 4 Invertebrate animals have more undifferentiated cells than vertebrate animals have.

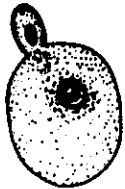
33 Which diagram represents binary fission?



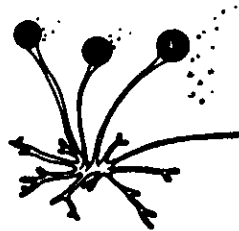
(1)



(3)



(2)



(4)

34 The process of meiotic cell division in a human male usually forms

- 1 one diploid cell, only
- 2 four diploid cells
- 3 one monoploid cell, only
- 4 four monoploid cells

35 Which reproductive adaptation is characteristic of most terrestrial vertebrates but *not* of most aquatic vertebrates?

- 1 external fertilization
- 2 internal fertilization
- 3 motile gametes
- 4 external development

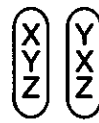
36 Based on the fact that a watermelon contains many seeds, what can be inferred about a normal flower of a watermelon plant?

- 1 It contains many sepals and petals.
- 2 It contains very large anthers.
- 3 It contains a large number of ovules.
- 4 It contains a large number of stamens.

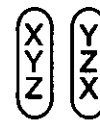
37 The spotted touch-me-not, a flowering plant, has seed pods that burst open when touched and forcefully eject their seeds. Such an adaptation is favorable because it

- 1 aids in the dispersal of the species
- 2 attracts insects that aid in pollination
- 3 prevents germination within the seed pod
- 4 can cause genetic changes to occur

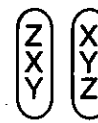
38 Which chromosome pair below best illustrates the gene-chromosome theory?



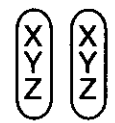
(1)



(2)



(3)

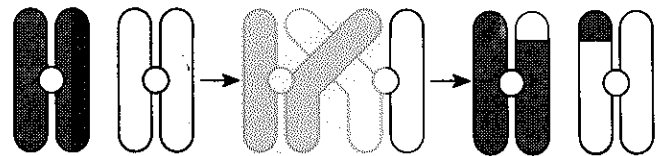


(4)

39 In squirrels, the gene for gray fur (G) is dominant over the gene for black fur (g). If 50% of a large litter of squirrels are gray, the parental cross that produced this litter was most likely

- (1) $GG \times Gg$
- (2) $GG \times GG$
- (3) $Gg \times gg$
- (4) $gg \times gg$

40 Which process is illustrated by the diagram below?



- 1 crossing-over
- 2 nondisjunction
- 3 sex determination
- 4 independent assortment

41 Which cross could produce a child with type O blood?

- (1) $I^A i \times I^B I^B$
- (2) $I^A I^A \times I^B i$
- (3) $I^A I^B \times ii$
- (4) $I^A i \times I^B i$

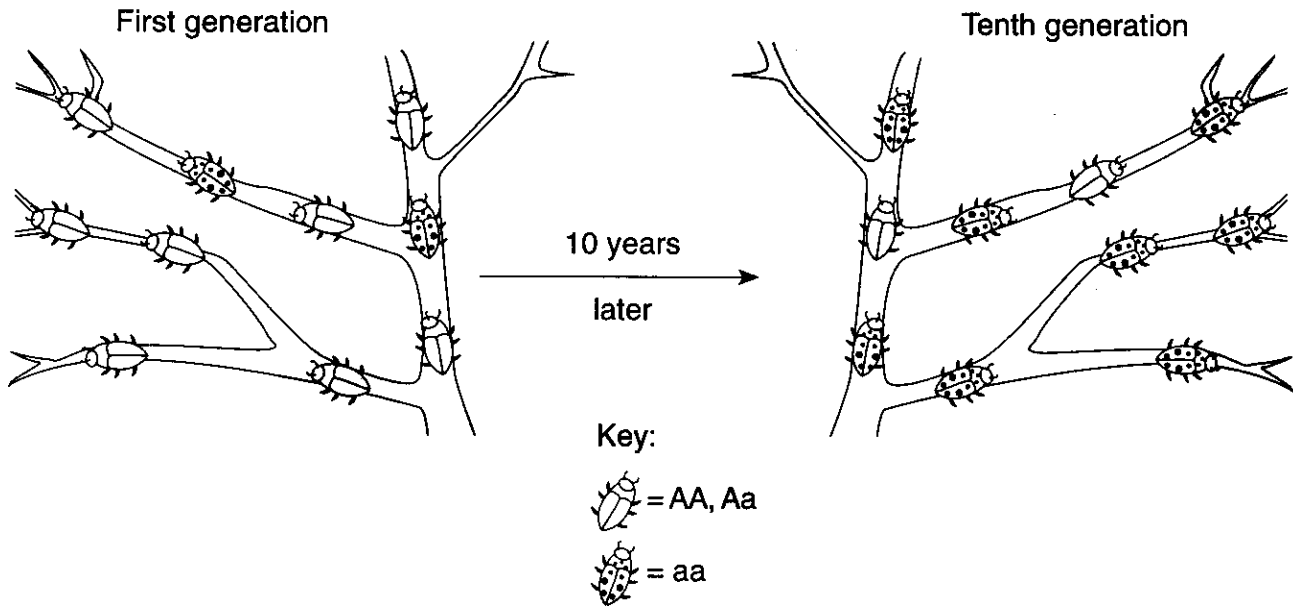
42 Breeders have developed a variety of chicken that has no feathers. Which methods were most likely used to produce this variety?

- 1 artificial selection and inbreeding
- 2 grafting and hybridization
- 3 regeneration and incubation
- 4 vegetative propagation and binary fission

43 A molecule of DNA is a polymer composed of

- 1 glucose
- 2 amino acids
- 3 fatty acids
- 4 nucleotides

- 44 The diagram below illustrates the change that occurred in the frequency of phenotypes in an insect population over 10 generations.



A probable explanation for this change would be that over time there was

- 1 a decrease in the adaptive value of gene *a*
- 2 an increase in the adaptive value of gene *a*
- 3 an increase in the population of this insect
- 4 a decrease in the mutation rate of gene *A*

- 45 In fruit flies with the curly wing mutation, the wings will be straight if the flies are kept at 16°C, but curly if they are kept at 25°C. The most probable explanation for this is that

- 1 fruit flies with curly wings cannot survive at high temperatures
- 2 the environment influences wing phenotype in these fruit flies
- 3 high temperatures increase the rate of mutations
- 4 wing length in these fruit flies is directly proportional to temperature

- 46 According to Darwin's theory of evolution, differences between species may be the result of

- 1 the disuse of body structures
- 2 the transmission of acquired characteristics
- 3 natural selection
- 4 mutagenic agents

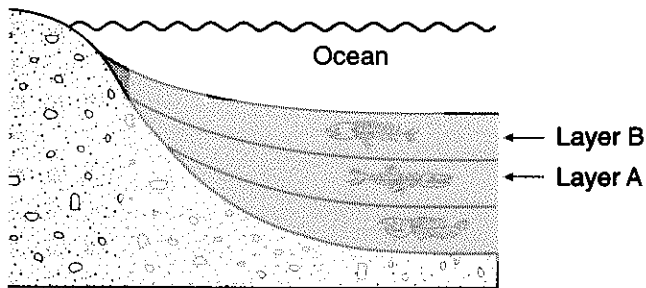
- 47 The concept that new varieties of organisms are still evolving is best supported by the

- 1 increasing need for new antibiotics
- 2 increasing number of individuals in the human population
- 3 decreasing number of new fossils discovered in undisturbed rock layers
- 4 decreasing activity of photosynthetic organisms due to warming of the atmosphere

- 48 Two nucleotide sequences found in two different species are almost exactly the same. This suggests that these species

- 1 are evolving into the same species
- 2 contain identical DNA
- 3 may have similar evolutionary histories
- 4 have the same number of mutations

49 The diagram below shows undisturbed sedimentary strata at the bottom of an ocean.



The fossils found in layer B resemble the fossils found in layer A. This similarity suggests that

- 1 the fossils in layer B were formed before the fossils in layer A
- 2 modern forms of life may have evolved from earlier forms of life
- 3 vertebrate fossils are only found in sediments
- 4 the fossils in layer A must be more complex than those in layer B

50 Variations within a species are most likely the result of

- 1 mutations and sexual reproduction
- 2 synapsis and disjunction
- 3 mitosis and asexual reproduction
- 4 overpopulation and recombination

51 The theory that evolutionary change is slow and continuous is known as

- 1 punctuated equilibrium
- 2 geographic isolation
- 3 speciation
- 4 gradualism

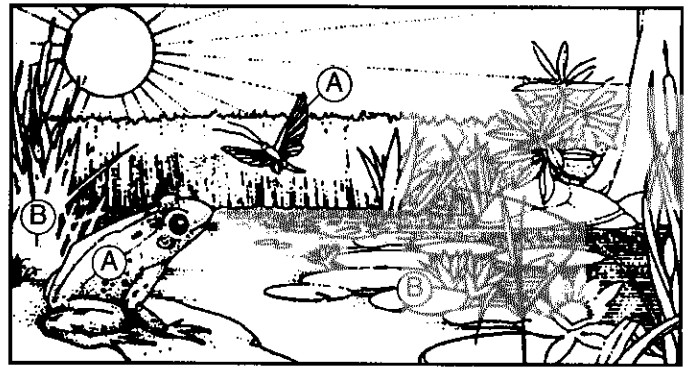
52 According to the heterotroph hypothesis, some early heterotrophs evolved into autotrophs because of their ability to synthesize organic compounds from water and

- | | |
|---------------------|------------|
| 1 carbon dioxide | 3 oxygen |
| 2 hydrochloric acid | 4 hydrogen |

53 All of Earth's water, land, and atmosphere within which life exists is known as

- | | |
|----------------|-----------------|
| 1 a population | 3 a biome |
| 2 a community | 4 the biosphere |

54 An ecosystem is represented below.



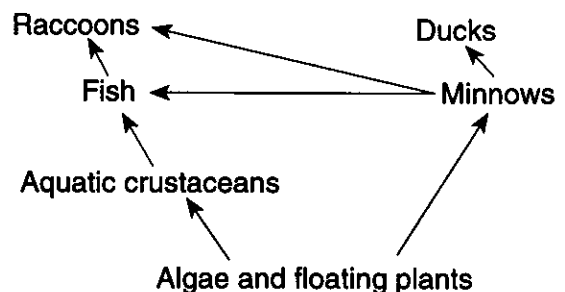
This ecosystem will be self-sustaining if

- 1 the organisms labeled A outnumber the organisms labeled B
- 2 the organisms labeled A are equal in number to the organisms labeled B
- 3 the type of organisms represented by B are eliminated
- 4 materials cycle between the organisms labeled A and the organisms labeled B

55 A certain plant requires moisture, oxygen, carbon dioxide, light, and minerals in order to survive. This statement shows that a living organism depends on

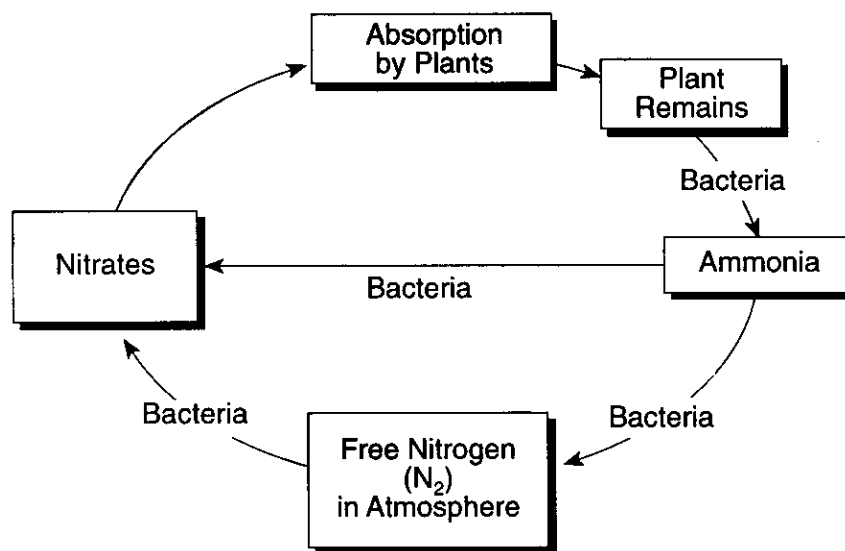
- 1 biotic factors
- 2 abiotic factors
- 3 symbiotic relationships
- 4 carnivore-herbivore relationships

56 Which statement best describes some organisms in the food web shown below?



- 1 Minnows and fish are primary consumers.
- 2 Algae and floating plants are decomposers.
- 3 Aquatic crustaceans are omnivores.
- 4 Raccoons, fish, and ducks are secondary consumers.

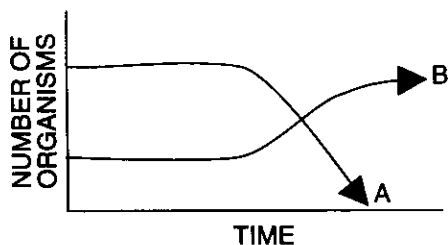
57 Events that take place in a biome are shown in the diagram below.



Which information is represented in the diagram?

- 1 Respiration and photosynthesis are interrelated.
- 2 Transpiration and condensation are related to the water cycle.
- 3 Decomposers release a material that is acted on by other organisms.
- 4 Predators and their prey are involved in many interactions.

58 The graph below shows the changes in two populations of herbivores in a grassy field.



A possible reason for these changes is that

- 1 all of the plant populations in this habitat decreased
- 2 population B competed more successfully for food than population A did
- 3 population A produced more offspring than population B did
- 4 population A consumed the members of population B

59 The creation of wildlife refuges and the enforcement of game laws are conservation measures that promote increased

- 1 use of biocides
- 2 preservation of species
- 3 use of biological controls
- 4 exploitation of species

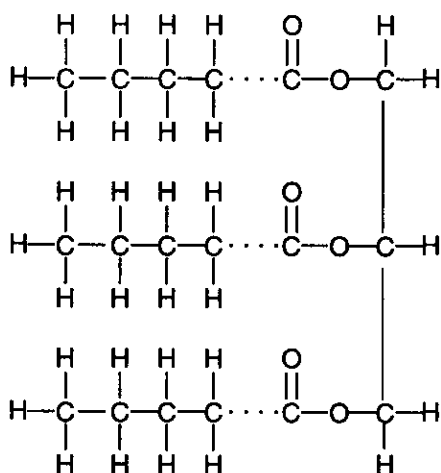
Part II

This part consists of five groups, each containing ten questions. Choose two of these five groups. Be sure that you answer all ten questions in each group chosen. Record the answers to these questions in accordance with the directions on the front page of this booklet. [20]

Group 1 — Biochemistry

If you choose this group, be sure to answer questions 60–69.

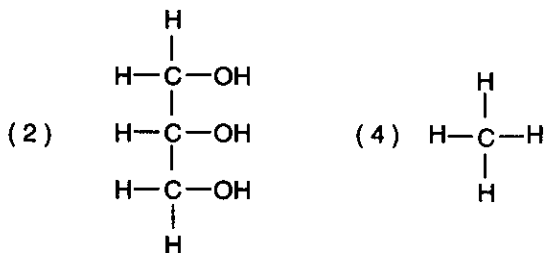
Base your answers to questions 60 and 61 on the structural formula of a molecule below and on your knowledge of biology.



60 Which statement best describes this molecule?

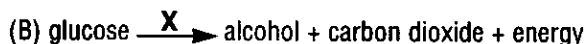
- 1 It has the ability to control heredity.
- 2 It has the ability to control reactions.
- 3 It has a high energy content.
- 4 It is involved in photosynthesis.

61 Which formula represents an end product derived from the chemical digestion of this molecule?



Base your answers to questions 62 and 63 on the two processes represented below and on your knowledge of biology.

Processes



62 Before the glucose in each process can be changed into the final products, it must first be converted to

- | | |
|----------------|------------|
| 1 pyruvic acid | 3 glycogen |
| 2 lactic acid | 4 lipids |

63 In both processes, the X represents

- | | |
|----------------------|-------------------|
| 1 catalysts | 3 monosaccharides |
| 2 hydrogen acceptors | 4 hormones |

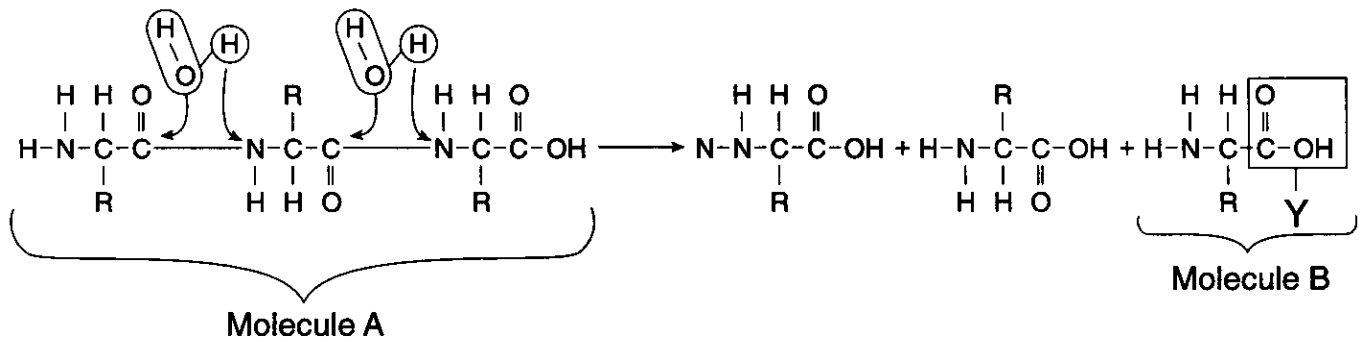
64 Which biological process is the main source of atmospheric oxygen?

- | | |
|---------------|---------------|
| 1 respiration | 3 hydrolysis |
| 2 photolysis | 4 deamination |

65 An element found in all proteins but *not* found in carbohydrates and lipids is

- | | |
|------------|------------|
| 1 carbon | 3 oxygen |
| 2 hydrogen | 4 nitrogen |

Base your answers to questions 66 and 67 on the diagram below and on your knowledge of biology.



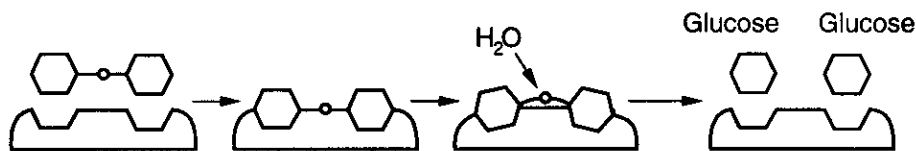
66 In molecule *B*, what type of group is contained in box *Y*?

- | | |
|--------------------|--------------------|
| 1 an amino group | 3 a carboxyl group |
| 2 a variable group | 4 a peptide group |

67 How many peptide bonds are present in molecule *A*?

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

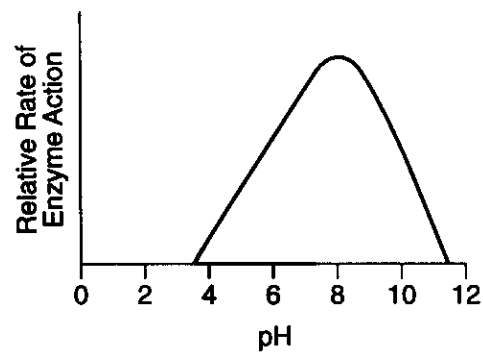
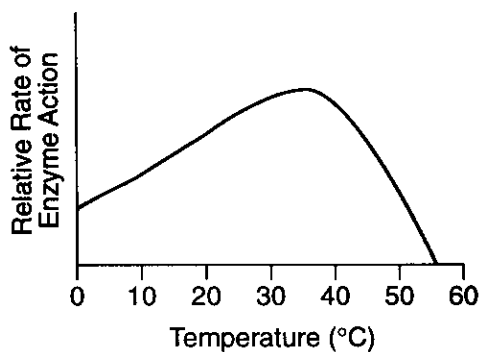
68 Which chemical reaction is represented by the diagram below?



- 1 dehydration synthesis of a dipeptide
- 2 hydrolysis of a polypeptide

- 3 dehydration synthesis of a lipid
- 4 hydrolysis of a disaccharide

69 Which statement best describes the enzyme represented in the graphs below?

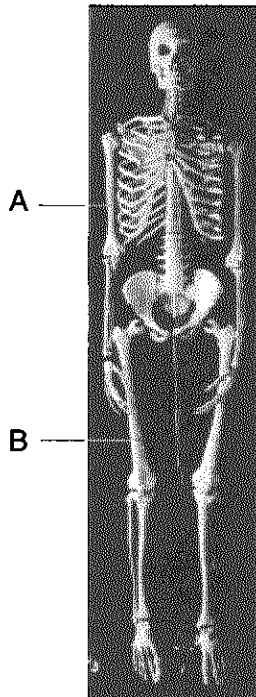


- 1 This enzyme works best at a temperature of 35°C and a pH of 8.
- 2 This enzyme works best at a temperature of 50°C and a pH of 12.
- 3 Temperature and pH have no effect on the action of this enzyme.
- 4 This enzyme works best at a temperature above 50°C and a pH above 12.

Group 2 — Human Physiology

If you choose this group, be sure to answer questions 70–79.

70 A human skeleton is shown in the photograph below.



The elongation of structures *A* and *B* was stimulated by a hormone produced by the

- | | |
|------------------------|--------------------|
| 1 islets of Langerhans | 3 pituitary gland |
| 2 liver | 4 striated muscles |

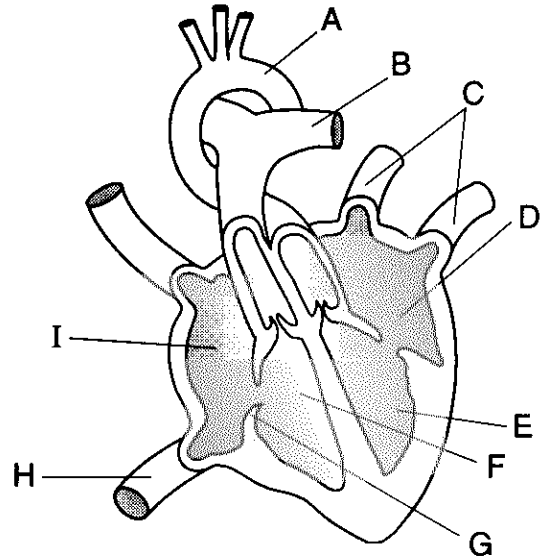
71 A heart attack may be due to all of the following *except*

- 1 an increase in arterial blood pressure
- 2 oxygen deprivation of cardiac muscle
- 3 narrowing of the arteries transporting blood to the heart muscle
- 4 decreased consumption of complex carbohydrates

72 Which food would provide the most roughage for the body?

- 1 baked fresh fish
- 2 lettuce-and-tomato salad
- 3 fried chicken breast
- 4 milkshake

Base your answers to questions 73 and 74 on the diagram below of the human heart and on your knowledge of biology.



73 Which structures are most closely associated with the transport of deoxygenated blood?

- | | |
|-------------------------------|-------------------------------|
| (1) <i>A, B,</i> and <i>C</i> | (3) <i>C, D,</i> and <i>E</i> |
| (2) <i>B, F,</i> and <i>I</i> | (4) <i>D, H,</i> and <i>I</i> |

74 A structure that prevents the backflow of blood into an atrium is indicated by letter

- | | |
|--------------|--------------|
| (1) <i>G</i> | (3) <i>C</i> |
| (2) <i>B</i> | (4) <i>H</i> |

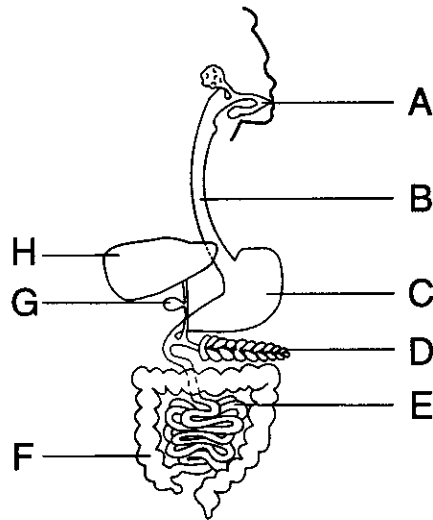
75 Which malfunction is most closely associated with connective tissue that is involved in human locomotion?

- | | |
|--------------|--------------|
| 1 bronchitis | 3 diabetes |
| 2 tendinitis | 4 meningitis |

76 Hardened deposits of cholesterol that accumulate in the structure that stores bile are known as

- | | |
|--------------|-------------|
| 1 gallstones | 3 goiters |
| 2 ulcers | 4 allergies |

Base your answers to questions 77 through 79 on the diagram below of the human digestive system and on your knowledge of biology.



77 In which structure does the initial hydrolysis of carbohydrates occur?

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

78 From which structure are glucose and amino acids normally absorbed into the circulatory system?

- (1) F
- (2) H
- (3) C
- (4) E

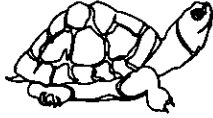
79 In which structure does extracellular chemical digestion of protein begin?

- (1) G
- (2) B
- (3) C
- (4) E

Group 3 — Reproduction and Development

If you choose this group, be sure to answer questions 80–89.

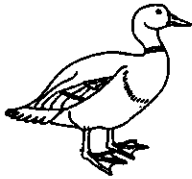
Base your answers to questions 80 and 81 on the diagrams below and on your knowledge of biology.



A



C



B



D

80 Which types of organisms usually develop from an egg containing an amnion?

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

81 Eggs that contain yolk are produced by

- 1 organisms A and B, only
- 2 organism B, only
- 3 organisms C and D, only
- 4 organisms A, B, C, and D

82 The endoderm in an embryo first forms during the process of

- 1 gametogenesis
- 2 zygote formation
- 3 blastula formation
- 4 gastrulation

83 Which sequence represents the correct order of events in the development of sexually reproducing animals?

- 1 fertilization → cleavage → differentiation → growth
- 2 cleavage → fertilization → growth → differentiation
- 3 growth → cleavage → fertilization → differentiation
- 4 fertilization → differentiation → cleavage → growth

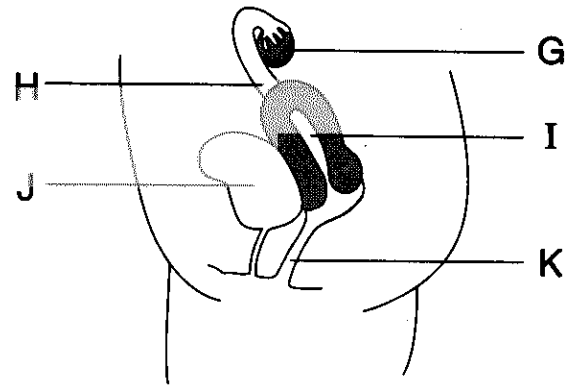
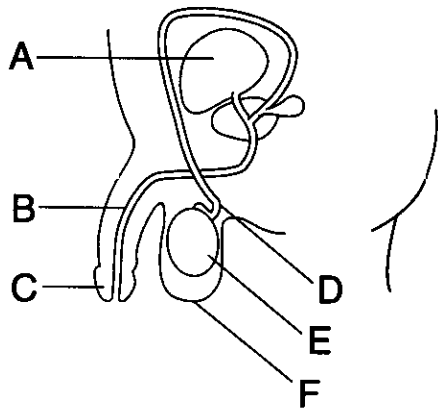
84 In most mammalian species, which structure supplies food to the developing embryo?

- 1 amnion
- 2 ovary
- 3 placenta
- 4 allantois

85 A temporary suspension of the menstrual cycle normally occurs during

- 1 menstruation
- 2 pregnancy
- 3 ovulation
- 4 menopause

Base your answers to questions 86 through 89 on the diagrams below and on your knowledge of biology.



86 Which structures secrete hormones that regulate the development of secondary sex characteristics?

- | | |
|-------------|-------------|
| (1) A and J | (3) F and I |
| (2) D and H | (4) E and G |

87 After sperm cells are deposited inside the female, the pathway they follow to reach the egg is from

- | | |
|-----------------|-----------------|
| (1) H to I to K | (3) K to I to H |
| (2) J to K to H | (4) G to H to I |

88 Gametogenesis occurs within structures

- | | |
|-------------|-------------|
| (1) A and J | (3) B and I |
| (2) E and G | (4) D and H |

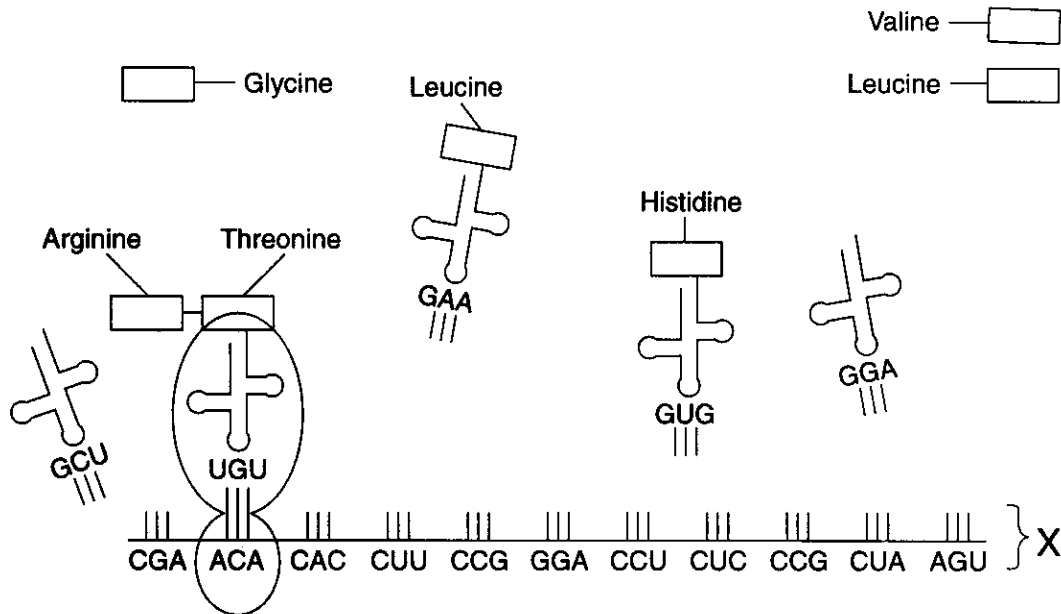
89 Which structures are directly affected by hormones involved in the menstrual cycle?

- | | |
|-------------|-------------|
| (1) C and E | (3) G and I |
| (2) A and D | (4) I and J |

Group 4 — Modern Genetics

If you choose this group, be sure to answer questions 90–99.

Base your answers to questions 90 through 92 on the diagram below of a biochemical process and on your knowledge of biology.



90 The synthesis of structure X occurred in the

- | | |
|-------------|------------|
| 1 nucleus | 3 lysosome |
| 2 cytoplasm | 4 vacuole |

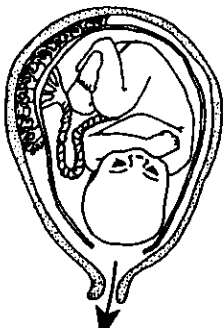
91 Which amino acid would be transferred to the position of codon CAC?

- | | |
|-----------|-------------|
| 1 leucine | 3 valine |
| 2 glycine | 4 histidine |

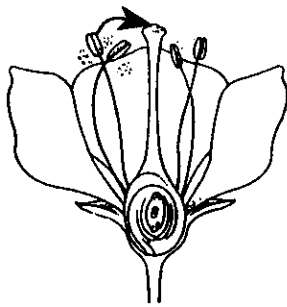
92 The biochemical process represented in the diagram is most closely associated with the cell organelle known as the

- | | |
|-------------|-----------------|
| 1 nucleolus | 3 chloroplast |
| 2 ribosome | 4 mitochondrion |

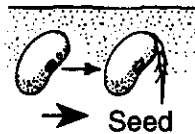
93 Which process represented by an arrow in the diagrams below is most similar to cloning?



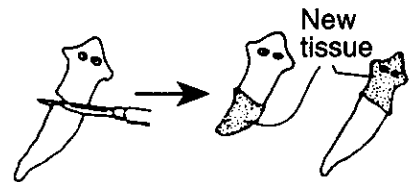
(1)



(2)

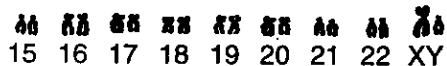
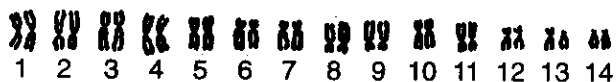


(3)



(4)

Base your answers to questions 94 and 95 on the diagram below and on your knowledge of biology.



94 The arrangement of chromosomes shown in the diagram is known as

- 1 a karyotype
- 2 a urine analysis
- 3 amniocentesis
- 4 blood typing

95 Examination of the diagram indicates that these are the chromosomes of a

- 1 female with Down syndrome
- 2 male with Down syndrome
- 3 female without Down syndrome
- 4 male without Down syndrome

96 Which condition would most likely produce a change in the gene pool of a population?

- 1 a large population
- 2 random mating in the population
- 3 migrations out of the population
- 4 no mutations in the population

Directions (97–98): For each phrase in questions 97 and 98, select the genetic disorder, chosen from the list below, that is best described by that phrase. Then record its number on the separate answer paper.

Genetic Disorders

- (1) PKU
- (2) Tay-Sachs
- (3) Sickle-cell anemia

97 Inability of individuals to metabolize phenylalanine

98 Directly affects cells involved in oxygen transport

99 Which change in chromosome structure involves the transfer of one section of a chromosome to a nonhomologous chromosome?

- 1 nitrogenous base substitution
- 2 translocation
- 3 crossing-over of linked genes
- 4 gene mutation

Group 5 — Ecology

If you choose this group, be sure to answer questions 100–109.

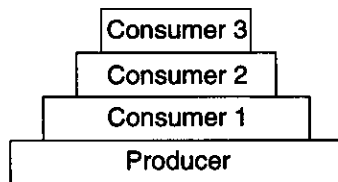
Directions (100–102): For each statement in questions 100 through 102, select the term, *chosen from the list below*, that is most closely associated with that statement. Then record its *number* on the separate answer paper.

Terms

- (1) Mutualism
- (2) Commensalism
- (3) Parasitism
- (4) Saprophytism
- (5) Competition

- 100 Protozoans living in the intestine of a termite secrete enzymes that digest cellulose, providing digestive end products of value to both organisms.
- 101 The roots of a mistletoe plant absorb nutrients from living oak trees, causing some damage to the tissues of the trees.
- 102 Certain fungi use dead organic matter for food.

- 103 The diagram below represents a biomass pyramid.



Which statement concerning the energy in this pyramid is correct?

- 1 The producer organisms contain the least amount of stored energy.
 - 2 Stored energy decreases from consumer 2 to consumer 3.
 - 3 Consumer 3 contains the greatest amount of stored energy.
 - 4 Stored energy increases from the producer to consumer 1.
- 104 One practice that has successfully increased the number of bald eagles in the United States is the
- 1 protection of their natural habitat
 - 2 importation of food to their nesting sites
 - 3 preservation of other eagle species that occupy the same niche
 - 4 increased use of pesticides

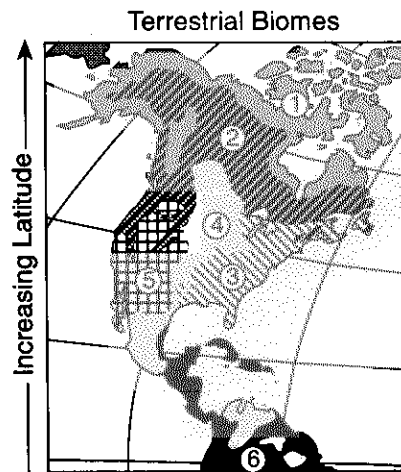
- 105 Which statement concerning the climax stage of an ecological succession is correct?

- 1 It changes rapidly.
- 2 It persists until the environment changes.
- 3 It is the first community to inhabit an area.
- 4 It consists entirely of plants.

- 106 In a pond, which change would most likely lead to terrestrial succession?

- 1 a decrease in the number of suspended particles in the pond water
- 2 an increase in current velocity of the pond water
- 3 a decrease in the number of diverse organisms in the shallow water of the pond
- 4 an increase in sediment, fallen leaves, and tree limbs accumulating on the bottom of the pond

Directions (107–109): The map below illustrates the general location of various terrestrial biomes in selected areas of North, Central, and South America. For each statement in questions 107 through 109, select the biome, *chosen from the map below*, that is most closely associated with that statement. Then record its *number* on the separate answer paper.



- 107 Snowy owls hunt mice that try to escape among the lichens growing on ground that has permanently frozen subsoil.
- 108 Prairie dogs hide in their burrows in a vast area of tall grasses that provide food for herds of pronghorn antelope and bison.
- 109 Deer nibble on low-lying shrubs while cardinals sit on branches of trees in a large deciduous forest

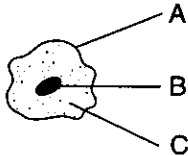
Part III

This part consists of five groups. Choose three of these five groups. 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. [15]

Group I

If you choose this group, be sure to answer questions 110–114.

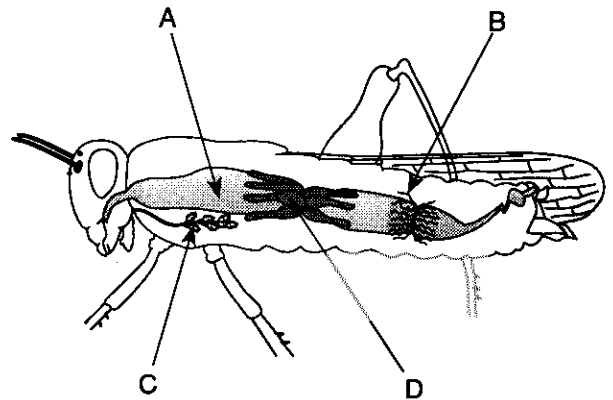
- 110 The diagram below represents a human cheek cell.



Select one of the lettered parts from the diagram and record the letter of the part chosen. Using one or more complete sentences, state a function of the part. You may use pen or pencil for your answer.

- 111 A new drug for the treatment of asthma is tested on 100 people. The people are evenly divided into two groups. One group is given the drug, and the other group is given a glucose pill. The group that is given the glucose pill serves as the
- | | |
|----------------------|-------------|
| 1 experimental group | 3 control |
| 2 limiting factor | 4 indicator |
- 112 A student used a compound light microscope to obtain data on the concentration of stomates in leaves. The student observed a small area of the lower epidermis of a leaf and counted two stomates in the high-power field of view. The student then observed an area of equal size from the upper epidermis of the same leaf and found no stomates in the high-power field of view. After making these observations, the student should
- 1 assume that leaves never have stomates on their upper surface
 - 2 conclude that the lower epidermis of this leaf has a greater stomate concentration than the upper epidermis
 - 3 conclude that the lower epidermis of all leaves has a greater stomate concentration than the upper epidermis
 - 4 make additional observations before drawing conclusions about stomate concentration

- 113 Which statement correctly identifies the function and relative location of two structures shown in the diagram below?



- 1 Digestive structure A is posterior to excretory structure B.
 - 2 Digestive structure C is ventral to digestive structure A.
 - 3 Excretory structure B is anterior to excretory structure D.
 - 4 Circulatory structure D is dorsal to respiratory structure C.
- 114 A scientific study showed that the depth at which algae were found in a lake varied from day to day. On clear days, the algae were found as much as 6 meters below the surface of the water but were only 1 meter below the surface on cloudy days. Which hypothesis best explains these observations?
- 1 Light intensity affects the growth of algae.
 - 2 Wind currents affect the growth of algae.
 - 3 Nitrogen concentration affects the growth of algae.
 - 4 Precipitation affects the growth of algae.

Group 2

If you choose this group, be sure to answer questions 115–119.

Base your answers to questions 115 through 118 on the information below and on your knowledge of biology.

A group of biology students extracted the photosynthetic pigments from spinach leaves using the solvent acetone. A spectrophotometer was used to measure the percent absorption of six different wavelengths of light by the extracted pigments. The wavelengths of light were measured in units known as nanometers (nm). One nanometer is equal to one-billionth of a meter. The following data were collected:

yellow light (585 nm) — 25.8% absorption
blue light (457 nm) — 49.8% absorption
orange light (616 nm) — 32.1% absorption
violet light (412 nm) — 49.8% absorption
red light (674 nm) — 41.0% absorption
green light (533 nm) — 17.8% absorption

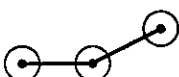
- 115 Complete all three columns in the data table on the separate answer paper so that the wavelength of light either increases or decreases from the top to the bottom of the data table. The data table below is provided for practice purposes only. Be sure your final answer appears on your answer paper. You may use pen or pencil for your answer.

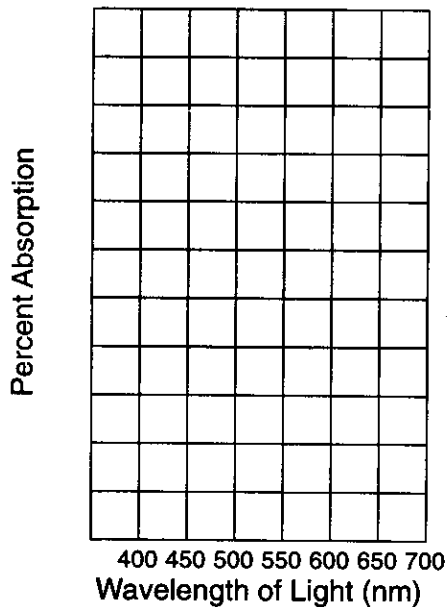
Color of Light	Wavelength of Light (nm)	Percent Absorption by Spinach Extract

Directions (116–117): 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 on the next page is provided for practice purposes only. Be sure your final answer appears on your answer paper. You may use pen or pencil for your answer.

- 116 Mark an appropriate scale on the axis labeled “Percent Absorption.”

- 117 Plot the data from the data table. Surround each point with a small circle and connect the points.

Example: 



118 Which statement is a valid conclusion that can be drawn from the data obtained in this investigation?

- 1 Photosynthetic pigments in spinach plants absorb blue and violet light more efficiently than red light.
 - 2 The data would be the same for all pigments in spinach plants.
 - 3 Green and yellow light are not absorbed by spinach plants.
 - 4 All plants are efficient at absorbing violet and red light.
-

119 Which set of laboratory equipment could a student use to determine whether or not apple juice contains simple sugars?

Set A	Set B	Set C	Set D
Safety goggles	Safety goggles	Safety goggles	Safety goggles
Bromthymol blue solution	Benedict's solution	Lugol's iodine solution	Lens paper
Test tubes	Test tubes	Scalpel	Hot water bath
Straw	Test tube holder	Forceps	Graduated cylinder
Water	Hot water bath	Graduated cylinder	Distilled water

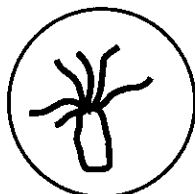
- (1) A
- (2) B

- (3) C
 - (4) D
-

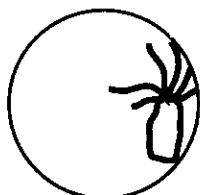
Group 3

If you choose this group, be sure to answer questions 120–124.

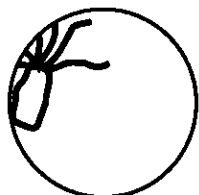
120 The diagram below represents a hydra as viewed through a compound light microscope.



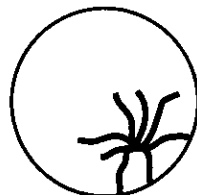
If the hydra moves toward the right of the slide preparation, which diagram best represents what will be observed through the microscope?



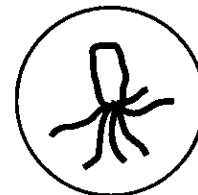
(1)



(2)

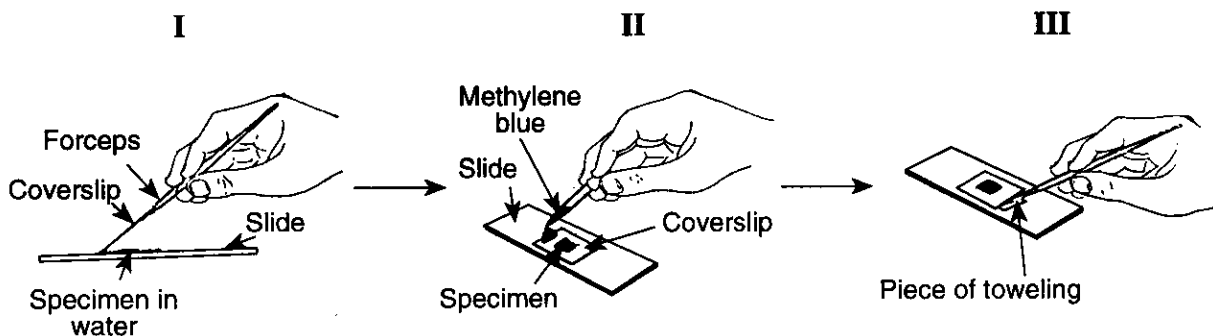


(3)



(4)

Base your answers to questions 121 and 122 on the diagram below and on your knowledge of biology.

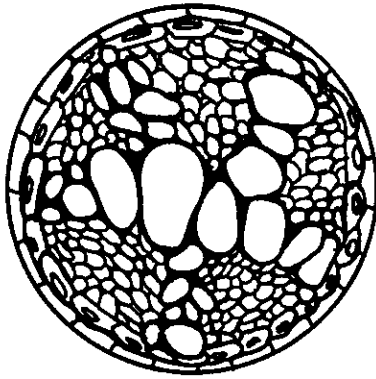


121 Which laboratory technique is illustrated in the diagram?

- 1 testing a specimen for amino acids
- 2 determining the pH of a specimen
- 3 measuring the photosynthetic rate in a specimen
- 4 preparing a wet mount of a specimen

122 Using one or more complete sentences, state a reason why methylene blue was used in the laboratory technique. You may use pen or pencil for your answer.

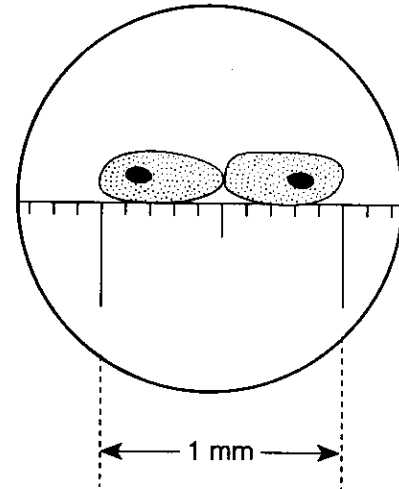
123 The diagram below shows a microscopic field containing a portion of the cross section of a root tip.



How should a student adjust the microscope in order to view a greater portion of the root tip?

- 1 stay at the same power and adjust the focus
- 2 stay at the same power but increase the size of the opening of the diaphragm
- 3 switch to a lower power and decrease the size of the opening of the diaphragm
- 4 switch to a higher power and adjust the focus

124 The diagram below represents two cells next to a metric measuring device under the low-power objective of a compound light microscope.



What is the approximate length of a nucleus of one of these cells?

- | | |
|-----------------------|------------------------|
| (1) 100 μm | (3) 1000 μm |
| (2) 500 μm | (4) 1500 μm |

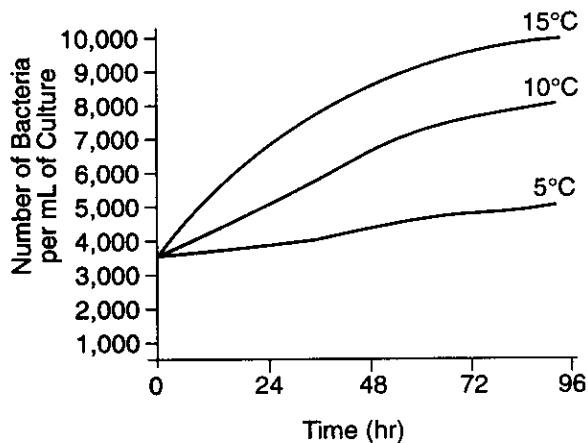
Group 4

If you choose this group, be sure to answer questions 125–129.

125 Which substance is a suitable indicator for detecting the presence of starch in a plant cell?

- (1) Fehling's solution (3) bromthymol blue
(2) pH paper (4) iodine solution

126 The graph below represents the results of an investigation of the growth of three identical bacterial cultures incubated at different temperatures.



Which inference can be made from this graph?

- 1 Temperature is unrelated to the reproductive rate of bacteria.
- 2 Bacteria cannot grow at a temperature of 5°C.
- 3 Life activities in bacteria slow down at high temperatures.
- 4 Refrigeration will most likely slow the growth of these bacteria.

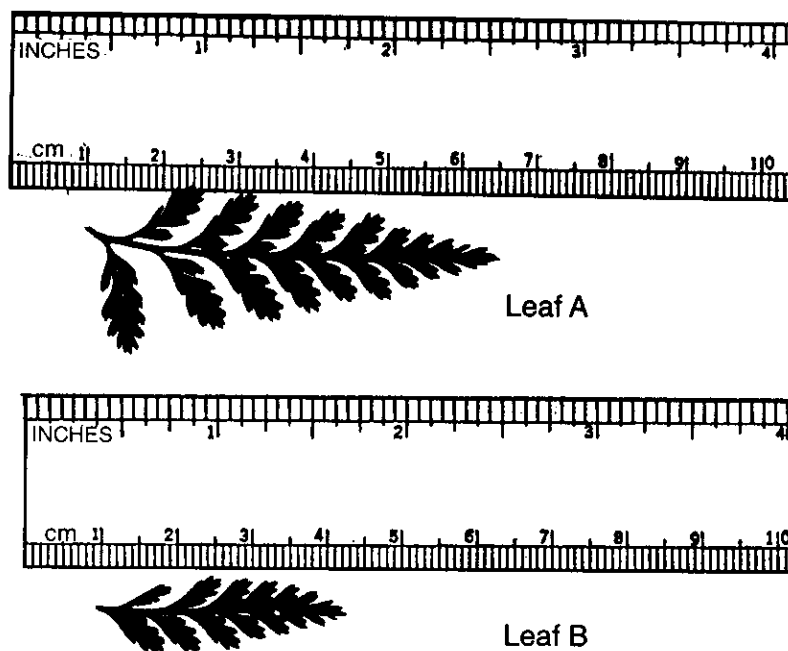
127 A study was conducted using two groups of 10 plants of the same species. During the study, the plants were placed in identical environmental conditions. The plants in one group were given a growth solution every 3 days. The heights of the plants in both groups were recorded at the beginning of the study and at the end of a 3-week period. The data showed that the plants given the growth solution grew faster than those not given the solution.

When other researchers conduct this study to test the accuracy of the results, they should

- 1 give growth solution to both groups
- 2 make sure the conditions are identical to those in the first study
- 3 give an increased amount of light to both groups of plants
- 4 double the amount of growth solution given to the first group

128 Using one or more complete sentences, explain why a test tube of material being heated over an open flame should *not* be stoppered. You may use pen or pencil for your answer.

129 The diagram below represents the measurements of two leaves.



The difference in length between leaves *A* and *B* is closest to

- (1) 20 mm
- (2) 20 cm
- (3) 0.65 m
- (4) 1.6 μ m

Group 5

If you choose this group, be sure to answer questions 130–134.

Base your answers to questions 130 through 133 on the reading passage below and on your knowledge of biology.

Take Two and Call Me in the Morning

Hippocrates observed that pain could be relieved by chewing the bark of a willow tree. We now know that this bark contains salicylic acid, which is similar to acetylsalicylic acid, the active ingredient in aspirin. Over 2,300 years after this observation by Hippocrates, scientists have learned how aspirin works.

When people get the flu or strain their backs, the body responds by making prostaglandins (PG), a group of hormonelike substances. The presence of certain prostaglandins may result in fever, headaches, and inflammation. Scientists have determined that aspirin interferes with prostaglandin H₂ synthase (PGHS-2), an enzyme that the body uses to make pain-causing prostaglandins. In 1994, the structure of this enzyme was found to be a crystal with a tube running up the middle of it. Raw materials move through this tunnel to reach the core of the enzyme, where they are transformed into prostaglandin molecules. Research has shown that aspirin blocks this tunnel. Part of the aspirin molecule attaches to a particular place inside the tunnel, preventing the raw materials from passing through the tunnel. This blockage interferes with the production of prostaglandins, thus helping to prevent or reduce fever, headaches, and inflammation.

The body makes two forms of the enzyme. PGHS-1 is found throughout the body and has a variety of uses, including protecting the stomach. PGHS-2 usually comes into play when tissue is damaged or when infections occur. Its action results in pain and fever. Aspirin plugs up the tunnel of PGHS-1 completely and often causes stomach irritation in some people. Aspirin plugs up the tunnel partially in PGHS-2, thus helping to relieve pain and fever.

Perhaps further research could result in a drug targeting PGHS-2 but not PGHS-1, relieving the aches, pains, and fever, but not irritating the stomach as aspirin does now.

130 How does aspirin relieve the symptoms of the flu?

- 1 It forms a barrier around the outer surface of PGHS-2 molecules, separating them from the prostaglandins.
- 2 It dissolves the crystal of the enzyme, preventing it from producing prostaglandins.
- 3 It is an acid that dissolves the prostaglandins that cause the symptoms.
- 4 It reduces the amount of raw material reaching the active site of the enzyme that produces prostaglandins.

131 Why does aspirin irritate the stomach of some people who take it?

- 1 It interferes with the activity of an enzyme that helps to protect the stomach.
- 2 It is the only acid in the stomach and irritates the stomach lining.
- 3 It stimulates prostaglandin production in the stomach.
- 4 It is obtained from willow bark, which cannot be digested in the stomach.

132 Using one or more complete sentences, describe the molecular structure of prostaglandin H₂ synthase. You may use pen or pencil for your answer.

133 Using one or more complete sentences, explain why chewing the bark of a willow tree could help relieve the symptoms of headache and fever. You may use pen or pencil for your answer.

134 Using one or more complete sentences, state one observation a student could make to determine that a slide preparation of unicellular organisms contained protists and *not* monerans. You may use pen or pencil for your answer.

BIOLOGY

Friday, June 19, 1998 — 9:15 a.m. to 12:15 p.m., only

Part I Score
(Use table below)	
Part II Score
Part III Score
Total Score
Rater's Initials:	

ANSWER PAPER

Student Sex: Male Female

Teacher School

All of your answers should be recorded on this answer paper.

Part I (65 credits)

1	1	2	3	4	21	1	2	3	4	41	1	2	3	4
2	1	2	3	4	22	1	2	3	4	42	1	2	3	4
3	1	2	3	4	23	1	2	3	4	43	1	2	3	4
4	1	2	3	4	24	1	2	3	4	44	1	2	3	4
5	1	2	3	4	25	1	2	3	4	45	1	2	3	4
6	1	2	3	4	26	1	2	3	4	46	1	2	3	4
7	1	2	3	4	27	1	2	3	4	47	1	2	3	4
8	1	2	3	4	28	1	2	3	4	48	1	2	3	4
9	1	2	3	4	29	1	2	3	4	49	1	2	3	4
10	1	2	3	4	30	1	2	3	4	50	1	2	3	4
11	1	2	3	4	31	1	2	3	4	51	1	2	3	4
12	1	2	3	4	32	1	2	3	4	52	1	2	3	4
13	1	2	3	4	33	1	2	3	4	53	1	2	3	4
14	1	2	3	4	34	1	2	3	4	54	1	2	3	4
15	1	2	3	4	35	1	2	3	4	55	1	2	3	4
16	1	2	3	4	36	1	2	3	4	56	1	2	3	4
17	1	2	3	4	37	1	2	3	4	57	1	2	3	4
18	1	2	3	4	38	1	2	3	4	58	1	2	3	4
19	1	2	3	4	39	1	2	3	4	59	1	2	3	4
20	1	2	3	4	40	1	2	3	4					

PART I CREDITS

Directions to Teacher:

In the table below, draw a circle around the number of right answers and the adjacent number of credits. Then write the number of credits (not the number right) in the space provided above.

No. Right	Credits	No. Right	Credits
59	65	29	36
58	64	28	35
57	63	27	34
56	62	26	33
55	61	25	32
54	60	24	31
53	59	23	31
52	58	22	30
51	57	21	29
50	56	20	28
49	55	19	27
48	54	18	26
47	54	17	25
46	53	16	24
45	52	15	23
44	51	14	21
43	50	13	20
42	49	12	18
41	48	11	17
40	47	10	15
39	46	9	14
38	45	8	12
37	44	7	11
36	43	6	9
35	42	5	8
34	41	4	6
33	40	3	5
32	39	2	3
31	38	1	2
30	37	0	0

No. right

Part II (20 credits)

Answer the questions in only two of the five groups in this part. Be sure to mark the answers to the groups of questions you choose in accordance with the instructions on the front page of the test booklet. Leave blank the three groups of questions you do not choose to answer.

**Group 1
Biochemistry**

- 60 1 2 3 4
61 1 2 3 4
62 1 2 3 4
63 1 2 3 4
64 1 2 3 4
65 1 2 3 4
66 1 2 3 4
67 1 2 3 4
68 1 2 3 4
69 1 2 3 4

**Group 3
Reproduction and
Development**

- 80 1 2 3 4
81 1 2 3 4
82 1 2 3 4
83 1 2 3 4
84 1 2 3 4
85 1 2 3 4
86 1 2 3 4
87 1 2 3 4
88 1 2 3 4
89 1 2 3 4

**Group 5
Ecology**

- 100 1 2 3 4 5
101 1 2 3 4 5
102 1 2 3 4 5
103 1 2 3 4
104 1 2 3 4
105 1 2 3 4
106 1 2 3 4
107 1 2 3 4 5 6
108 1 2 3 4 5 6
109 1 2 3 4 5 6

**Group 2
Human Physiology**

- 70 1 2 3 4
71 1 2 3 4
72 1 2 3 4
73 1 2 3 4
74 1 2 3 4
75 1 2 3 4
76 1 2 3 4
77 1 2 3 4
78 1 2 3 4
79 1 2 3 4

**Group 4
Modern Genetics**

- 90 1 2 3 4
91 1 2 3 4
92 1 2 3 4
93 1 2 3 4
94 1 2 3 4
95 1 2 3 4
96 1 2 3 4
97 1 2 3
98 1 2 3
99 1 2 3 4

Part III (15 credits)

Answer the questions in only three of the five groups in this part. Leave blank the groups of questions you do not choose to answer.

Group 1

110 _____

111 1 2 3 4

112 1 2 3 4

113 1 2 3 4

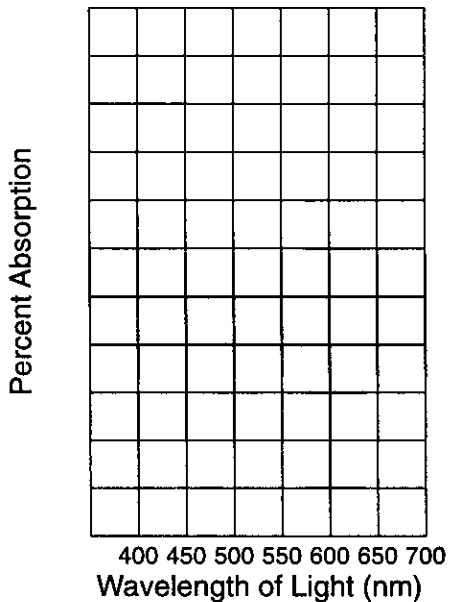
114 1 2 3 4

Group 2

115

Color of Light	Wavelength of Light (nm)	Percent Absorption by Spinach Extract

116–117



118 1 2 3 4

119 1 2 3 4

Group 3

120 1 2 3 4

121 1 2 3 4

122 _____

123 1 2 3 4

124 1 2 3 4

Group 4

125 1 2 3 4

126 1 2 3 4

127 1 2 3 4

128 _____

129 1 2 3 4

Group 5

130 1 2 3 4

131 1 2 3 4

132 _____

133 _____

134 _____

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