

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

BIOLOGY

Thursday, August 13, 1998 — 12:30 to 3:30 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.

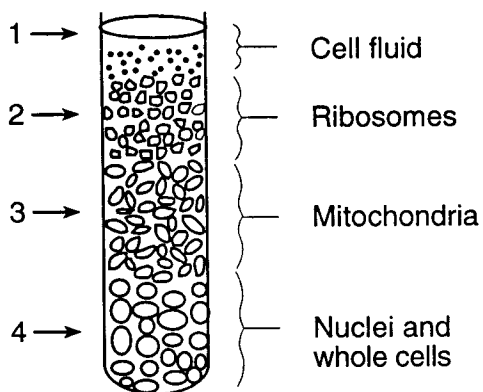
DO NOT OPEN THIS EXAMINATION BOOKLET UNTIL THE SIGNAL IS GIVEN.

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.

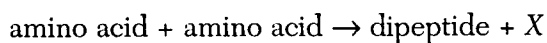
1 The diagram below represents results obtained in a study of a suspension containing both broken and whole cells.



Which statement best describes the technique used to obtain these results?

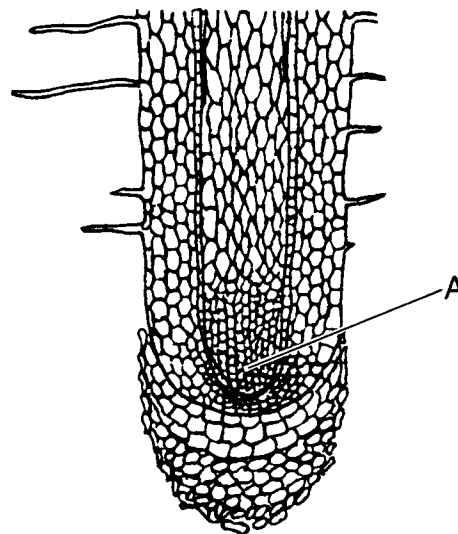
- 1 A compound light microscope was used to show that the organelles in region 1 weigh less than those in region 2.
 - 2 An electron microscope was used to show that the organelles in region 3 are the most complex.
 - 3 Chromatography was used to determine that the organelles in region 1 are more soluble than those in region 2.
 - 4 An ultracentrifuge was used to separate the organelles with varying densities into regions 1 through 4.
- 2 An animal maintains its fluid balance by regulating the gain and loss of water. This maintenance is an example of
- | | |
|---------------|---------------|
| 1 homeostasis | 3 cyclosis |
| 2 hydrolysis | 4 peristalsis |

3 Which substance is most likely represented by letter X in the equation below?



- | | |
|---------------------|--------------|
| 1 salt | 3 water |
| 2 hydrochloric acid | 4 fatty acid |

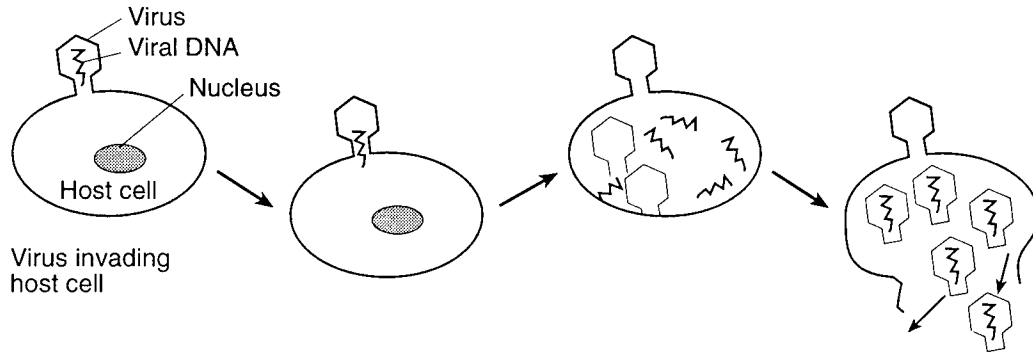
4 The diagram below represents the longitudinal section of an onion root tip.



Which activity is most closely associated with the cells in region A?

- | | |
|--------------|--------------|
| 1 ingestion | 3 growth |
| 2 locomotion | 4 protection |
- 5 A scientist recently discovered a pond organism that is unicellular, contains chloroplasts and other membrane-bound organelles, and possesses a flagellum. In which kingdom is this organism classified?
- | | |
|------------|---------|
| 1 monera | 3 fungi |
| 2 protista | 4 plant |
- 6 A chemical analysis of organisms from each kingdom shows that living things are primarily composed of the elements
- 1 carbon, hydrogen, chlorine, and sulfur
 - 2 carbon, hydrogen, oxygen, and nitrogen
 - 3 iron, calcium, hydrogen, and oxygen
 - 4 chlorine, carbon, calcium, and sulfur

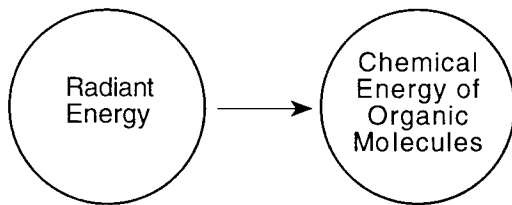
7 Viral activity is represented in the diagram below.



Invading the host cell enables the virus to

- | | |
|----------------------------|--------------------|
| 1 increase its size | 3 obtain nutrients |
| 2 synthesize needed oxygen | 4 reproduce |

8 Which process is represented by the arrow in the diagram below?



- 1 fermentation
- 2 photosynthesis
- 3 oxidation of glucose
- 4 hydrolysis of nutrients

9 Which organism obtains organic molecules from other organisms by extracellular digestion and absorption?

- | | |
|--------------|--------------|
| 1 tulip | 3 bean plant |
| 2 maple tree | 4 mushroom |

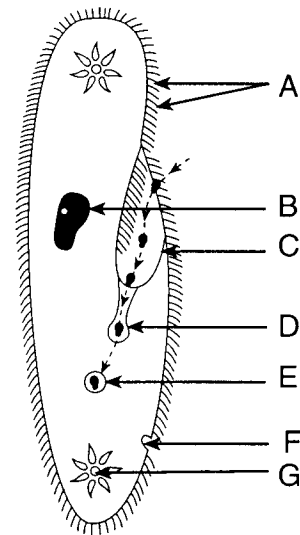
10 The flowing cytoplasm of an active ameba is an adaptation for

- 1 extracellular digestion
- 2 intracellular circulation
- 3 glucose synthesis
- 4 lipid synthesis

11 The process that removes metabolic waste products from an organism is known as

- | | |
|-------------|-------------|
| 1 egestion | 3 excretion |
| 2 secretion | 4 oxidation |

12 Which structures in the diagram of a paramecium below are most directly associated with the life function of nutrition?



- | | |
|--------------------|-----------------|
| (1) A, C, D, and E | (3) D, E, and G |
| (2) B, E, F, and G | (4) A, B, and G |

13 In the grasshopper and earthworm, the efficiency of food absorption is increased by the presence of

- 1 a large stomach, which secretes hormones
- 2 infolds, which add surface area to the digestive tube
- 3 the pancreas, which secretes digestive enzymes into the intestine
- 4 the liver, which absorbs excess sugar and stores it as glycogen

14 Vascular tissue is vital to the health of a plant because it

- 1 transports food and water
- 2 hydrolyzes nitrogenous wastes
- 3 assists in ingestion
- 4 produces food and oxygen

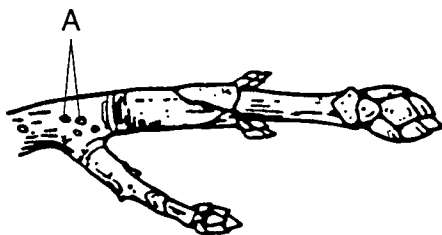
15 Which statement regarding respiration is correct?

- 1 Respiration in autotrophic organisms occurs only during the day.
- 2 Fungi and monerans carry out aerobic respiration only.
- 3 All living organisms carry out some form of respiration.
- 4 All autotrophs and heterotrophs require glucose and oxygen for respiration.

16 The tracheal tubes of grasshoppers, the moist skin of earthworms, and the alveoli of humans are structural adaptations that aid in

- 1 autotrophic nutrition
- 2 heterotrophic nutrition
- 3 anaerobic respiration
- 4 aerobic respiration

17 The structures indicated by letter A in the diagram below are found along the surface of a tree branch.



The main function of these structures is to aid in the

- 1 exchange of oxygen and carbon dioxide
- 2 ingestion of food and water
- 3 excretion of nitrogenous wastes
- 4 transport of auxins

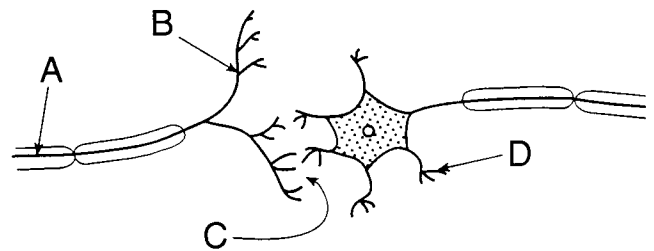
18 A change that initiates an electrochemical message along a neuron is known as

- | | |
|---------------|--------------|
| 1 an effector | 3 a response |
| 2 a stimulus | 4 an impulse |

19 The hydra and the ameba are similar in that both organisms

- 1 eliminate ammonia and carbon dioxide through the cell membrane
- 2 move by means of pseudopods
- 3 surround prey with tentacles
- 4 carry out both intracellular and extracellular digestion

20 Which letter in the diagram below indicates a synapse?

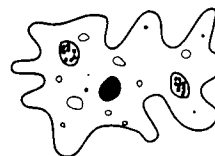


- | | |
|-------|-------|
| (1) A | (3) C |
| (2) B | (4) D |

21 What causes the stem of a tomato plant to bend toward light?

- 1 unequal auxin distribution
- 2 the adhesive property of water
- 3 transpirational pull
- 4 the storage of glucose

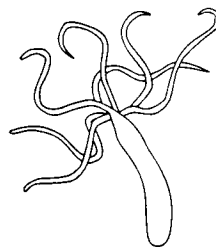
22 Which organism represented below is often described as a sessile organism?



(1)



(3)

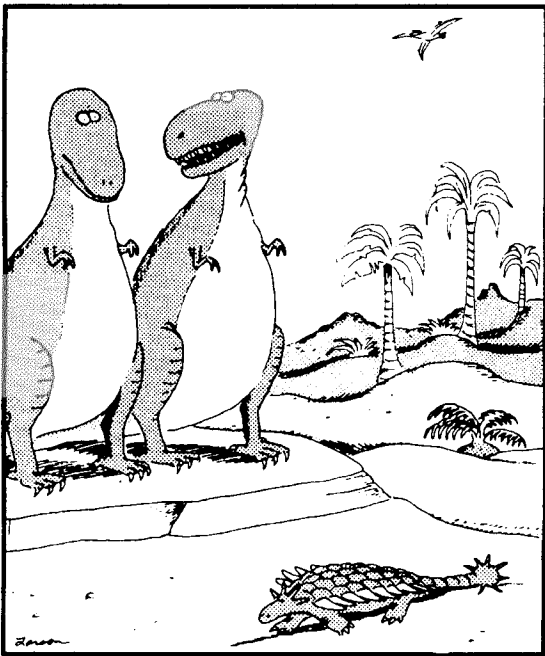


(2)



(4)

23 Which life activity is suggested by the cartoon below?



"It's roughage, and that's about it."

- | | |
|----------------|--------------|
| 1 circulation | 3 absorption |
| 2 reproduction | 4 nutrition |

24 In humans, chemical digestion is accomplished by enzyme action that begins in the mouth and ends in the

- | | |
|-------------|-------------------|
| 1 esophagus | 3 small intestine |
| 2 stomach | 4 gallbladder |

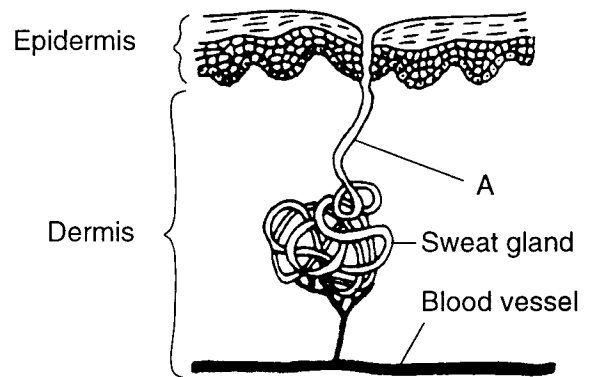
25 Which transport vessel is correctly paired with its usual function?

- 1 lymph vessel — carries blood toward the heart
- 2 capillary — provides a site for the exchange of materials between the blood and body tissues
- 3 artery — filters bacteria and dead cells from the lymph and the blood
- 4 vein — produces white blood cells

26 The secretion of chemicals that stimulate responses in specific body tissues is a function of

- 1 the nervous system, only
- 2 the endocrine system, only
- 3 both the nervous system and the endocrine system
- 4 neither the nervous system nor the endocrine system

27 The diagram below illustrates some structures of the skin.



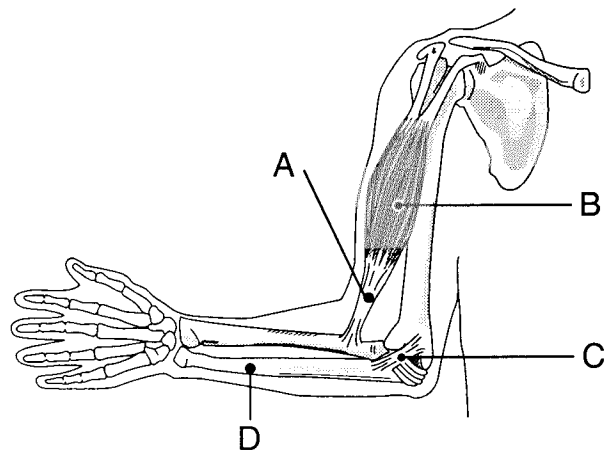
A substance that blocks structure A would directly interfere with

- 1 cellular respiration
- 2 storage of urea
- 3 dehydration synthesis
- 4 temperature regulation

28 Which structures filter and moisten air as it passes through the human respiratory system?

- 1 cilia and mucous membranes
- 2 alveoli and cartilage rings
- 3 diaphragm and bronchioles
- 4 epiglottis and bronchi

29 Some structures in the human arm are shown in the diagram below.



A ligament is represented by the structure labeled

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

30 The phrases below describe several events that occur during the process of mitosis.

- (A) attachment of double-stranded chromosomes to the spindle apparatus
- (B) formation of single-stranded chromosomes, which are moved to opposite ends of the cell
- (C) disintegration of the nuclear membrane
- (D) nuclear membrane formation around each set of chromosomes, forming two nuclei
- (E) synthesis of a spindle apparatus

Which sequence represents the correct order of these events?

- (1) $A \rightarrow B \rightarrow C \rightarrow D \rightarrow E$
- (2) $B \rightarrow D \rightarrow A \rightarrow C \rightarrow E$
- (3) $A \rightarrow D \rightarrow E \rightarrow B \rightarrow C$
- (4) $C \rightarrow E \rightarrow A \rightarrow B \rightarrow D$

31 A student using a compound light microscope is observing cells undergoing mitotic cell division. If the cells are from a bean plant, which process could the student observe?

- 1 the formation of a cell plate between two new cells
- 2 the replication of centrioles
- 3 a pinching-in of the cell membrane to form two cells
- 4 the pairing of homologous chromosomes

32 The healing of a wound in a human is most similar to the process of

- 1 budding
- 2 sporulation
- 3 regeneration
- 4 sporulation

33 A normal body cell of a fruit fly contains eight chromosomes. Each normal gamete of this organism contains only four chromosomes, as a result of the process of

- 1 binary fission
- 2 vegetative propagation
- 3 germination
- 4 meiosis

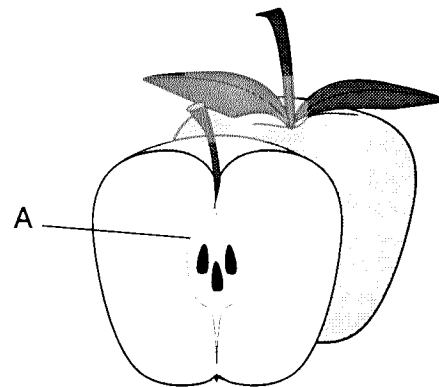
34 The exchange of nutrients and gases between a developing human embryo and its mother occurs between circulatory fluids located within the

- 1 umbilical cord
- 2 placenta
- 3 mammary glands
- 4 yolk

35 A characteristic of fertilization in most terrestrial vertebrates is the

- 1 fusion of gametes in a moist internal environment
- 2 fusion of gametes in a dry external environment
- 3 release of thousands of eggs
- 4 release of nonmotile sperm

36 From which flower part does structure A in the diagram below develop?



- 1 stamen
- 2 petal
- 3 anther
- 4 ovary

37 Which statement about reproduction in flowering plants is *not* correct?

- 1 Pollen grains are transferred from the anther to the stigma.
- 2 Petals and nectar are adaptations that increase the chance of pollination.
- 3 The pollen grain requires water to swim from the stamen to the pistil.
- 4 A pollen tube develops in the pistil after pollination.

38 Heterozygous pink snapdragons are an example of intermediate inheritance in plants. These pink-flowered plants may be produced as a result of

- 1 a cross between parent plants whose flower color is different from that of their offspring
- 2 the expression of a dominant gene
- 3 the expression of a recessive gene
- 4 a cross between parent plants, both of which have flowers with red petals

39 Which method was used by Gregor Mendel to develop the principles of dominance and segregation?

- 1 mathematical analysis of pea plant crosses
- 2 microscopic study of pea plant chromosomes
- 3 study of mutagenic agents affecting pea plants
- 4 chemical analysis of pea plant DNA

40 In canaries, the gene for singing (*S*) is dominant over the gene for nonsinging (*s*). When hybrid singing canaries are mated with nonsinging canaries, what percentage of the offspring is likely to possess the singing trait?

- (1) 0%
- (2) 25%
- (3) 50%
- (4) 100%

41 A certain species of moth may have antennae that are feathery or nonfeathery. Those with feathery antennae usually have red eyes, and those with nonfeathery antennae usually have white eyes. If antenna type and eye color are each controlled by a single pair of genes, a valid conclusion that can be drawn regarding the genes for antenna type and eye color is that these genes are

- 1 on separate chromosomes
- 2 linked
- 3 polyploid
- 4 found at the same locus

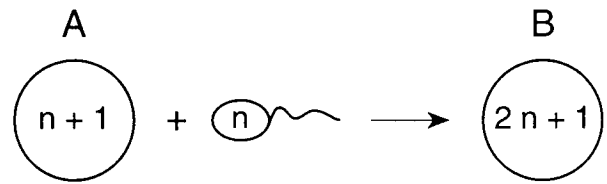
42 The chart below shows the genotype of four babies with regard to blood type.

Baby	Genotype
W	$I^A I^A$
X	$I^B I^B$
Y	ii
Z	$I^A I^B$

Which baby could *not* be the child of parents who both have type AB blood?

- (1) W
- (2) X
- (3) Y
- (4) Z

43 The diagram below illustrates fertilization in a human.



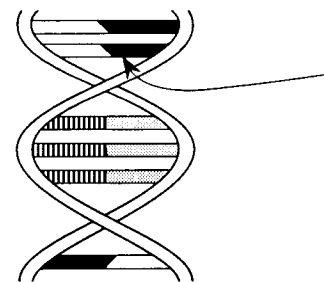
Which type of individual might result from this fertilization?

- 1 a $3n$ individual
- 2 an individual with Down syndrome
- 3 a normal diploid individual
- 4 a monoploid, colorblind individual

44 Scientific investigation of human genetics has been limited because

- 1 humans have a long life cycle and few offspring
- 2 the principles of genetics do not appear to apply to humans
- 3 genetic counseling has not been applied to humans
- 4 environmental factors limit the number of mutations in humans

45 The diagram below represents Watson and Crick's model of DNA.



The substance indicated by the arrow could be

- 1 thymine
- 2 deoxyribose
- 3 ribose
- 4 uracil

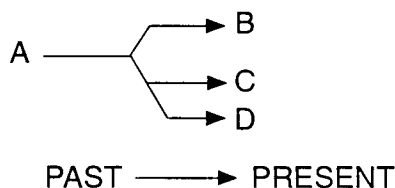
46 Which concept includes the other three?

- 1 competition
- 2 survival of the fittest
- 3 natural selection
- 4 overproduction

47 One concept that supports the theory of evolution states that organisms best adapted for survival are the ones that will reproduce and pass traits on to future generations. Adaptations that can be passed on do *not* include

- 1 the basic structure of the organism
- 2 the reflex actions of the organism
- 3 the manner in which the organism carries out respiration
- 4 techniques for hunting food taught by the parents of the organism

48 In the diagram below, *B*, *C*, and *D* represent organisms that exist in the present time and show a striking similarity to each other in their bone structure.



In the diagram, letter *A* most likely represents

- 1 homologous structures
- 2 a common ancestor
- 3 an acquired characteristic
- 4 geographic distribution

49 Two organisms are closely related and are thought to share a similar evolutionary history. If this assumption is correct, these organisms most likely have

- 1 no structural differences
- 2 few biochemical similarities
- 3 identical chromosome mutations
- 4 similar embryological development

50 One way that the modern theory of evolution differs from the theory of evolution proposed by Charles Darwin is that the modern theory

- 1 includes the concept of use and disuse
- 2 does not include the concept of overproduction
- 3 identifies mutations as one explanation for variations
- 4 does not consider the effects of genetic change

51 A large population of wildcats is broken up into several small groups as a result of geographic isolation. Over a long period of time, these groups will most likely become

- 1 reproductively isolated
- 2 identical in genotypes
- 3 identical in phenotypes
- 4 artificially selected

52 According to the heterotroph hypothesis, aerobic activity in organisms could not evolve until

- 1 anaerobes added alcohol to the environment
- 2 autotrophs added carbon dioxide to the environment
- 3 autotrophs released free oxygen into the environment
- 4 anaerobes released ammonia into the environment

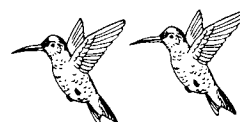
53 Which group can best be described as a population?

- 1 all the honeybees in an orchard
- 2 all the plants and animals in a forest
- 3 the living and nonliving factors in a meadow
- 4 the life in Earth's atmosphere

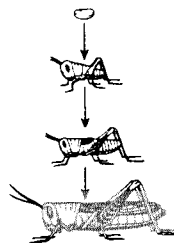
54 Which diagram best represents an ecosystem?



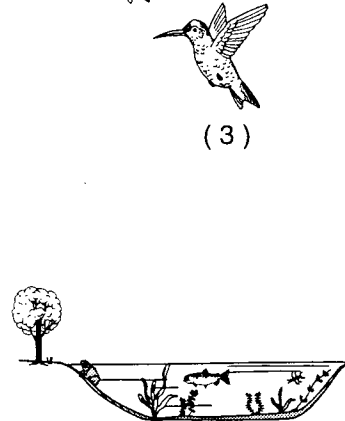
(1)



(3)

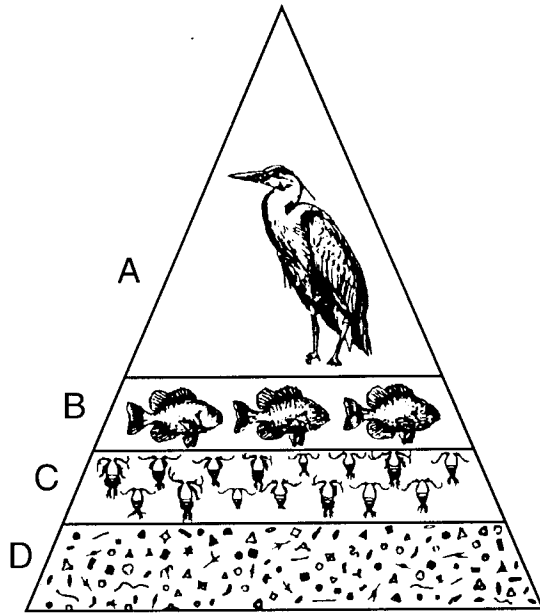


(2)



(4)

55 A food pyramid is represented below.



Which statement best describes one of the levels of this pyramid?

- 1 Level A contains the largest producers in the pyramid.
- 2 The organisms in level B obtain food directly from level A.
- 3 Level C contains the largest group of consumers in the pyramid.
- 4 Level D contains the greatest number of heterotrophs in the pyramid.

56 In a natural community, all the living things that directly or indirectly affect the environment are known as

- 1 pioneer organisms
- 2 secondary consumers
- 3 climatic limitations
- 4 biotic factors

57 A fungus is an example of

- 1 an herbivore
- 2 a saprophyte
- 3 an autotroph
- 4 an omnivore

58 Several years after a building had been torn down and the ground cleared, grasses began to grow in that area. After 10 years, small bushes replaced the grasses. This pattern of plant growth is known as

- 1 biological control
- 2 ecological succession
- 3 land-use management
- 4 cover cropping

59 In order to preserve the biosphere for future generations, humans must

- 1 make use of technology to develop new herbicides
- 2 put all wild animals in game preserves
- 3 explore ways to drain and fill wetlands along the seacoast
- 4 understand how living things interact with their environment

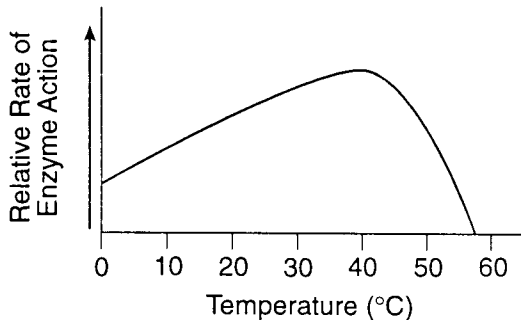
Part II

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 through 62 on the graph below and on your knowledge of biology.



60 Which statement most accurately represents information shown in the graph?

- 1 Enzyme rates are not affected by cold temperatures.
- 2 At 0°C, the enzyme is inactive.
- 3 The enzyme is more active at 25°C than at 50°C.
- 4 The enzyme is less active at 55°C than at 58°C.

61 Which factor most likely accounts for the change in the rate of enzyme action as the temperature increases from 40°C to 58°C?

- 1 Excess acids have been building up, causing the enzyme to become fatigued.
- 2 Too much substrate is present at these high temperatures.
- 3 Not enough substrate is present at these high temperatures.
- 4 The high temperature causes the shape of the enzyme to be altered.

62 The graph could best be used to illustrate

- 1 enzyme composition
- 2 optimum enzyme activity
- 3 functions of coenzymes
- 4 enzyme molecule size

Directions (63–64): For each statement in questions 63 and 64, select the chemical reaction, chosen from the list below, that is most closely associated with that statement. Then record its number on the separate answer paper.

Chemical Reactions

- (1) $2 \text{ pyruvic acid} \rightarrow 2 \text{ ethyl alcohol} + 2 \text{ CO}_2$
- (2) $2 \text{ pyruvic acid} \rightarrow 2 \text{ lactic acid}$
- (3) $2 \text{ pyruvic acid} + 6 \text{ O}_2 \rightarrow 6 \text{ H}_2\text{O} + 6 \text{ CO}_2 + 34 \text{ ATP}$

63 This reaction is used in the brewing industry.

64 This reaction occurs in humans when muscle cells do not receive an adequate supply of oxygen.

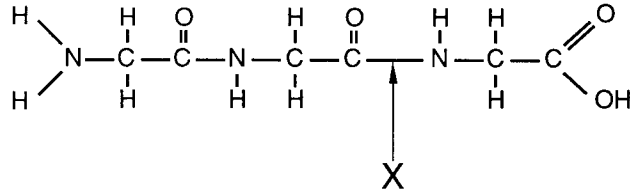
65 In plants, a storage product that results from the dehydration synthesis of many glucose molecules is

- | | |
|---------------|----------|
| 1 protein | 3 an oil |
| 2 a phosphate | 4 starch |

66 An enzyme that works best in an acidic environment would function best at a pH of

- | | |
|--------|-------|
| (1) 11 | (3) 3 |
| (2) 9 | (4) 7 |

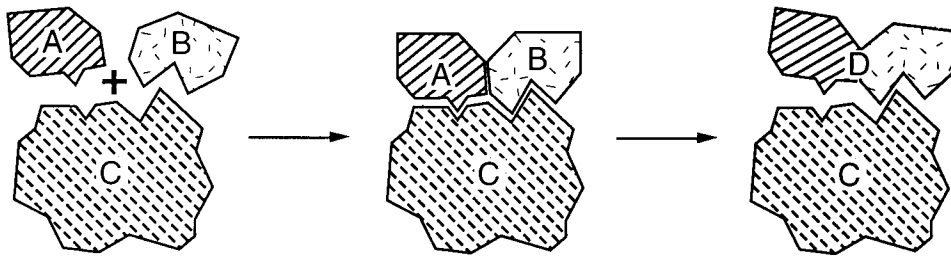
67 The structural formula of a molecule is shown below.



The part of the molecule indicated by X is known as a

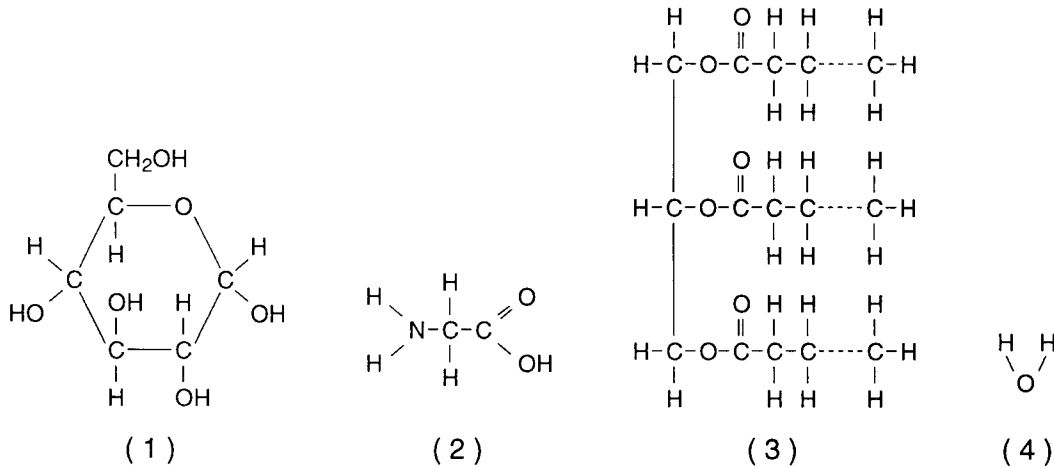
- 1 carboxyl group
- 2 hydrogen bond
- 3 peptide bond
- 4 variable side group

68 Which concept is illustrated by the reaction shown in the diagram below?



- 1 protein hydrolysis
- 2 enzyme specificity
- 3 active transport
- 4 polypeptide ingestion

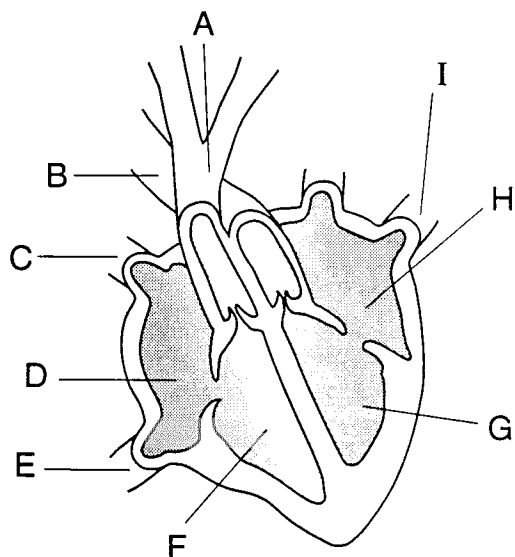
69 Liposuction is the removal of stored fat from the human body. Which type of molecule is most directly involved in this process?



Group 2 — Human Physiology

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

Base your answers to questions 70 through 72 on the diagram below of the human heart and on your knowledge of biology.



70 A blockage in structure A would directly reduce blood flow to the

- 1 heart
- 2 lungs
- 3 liver
- 4 brain

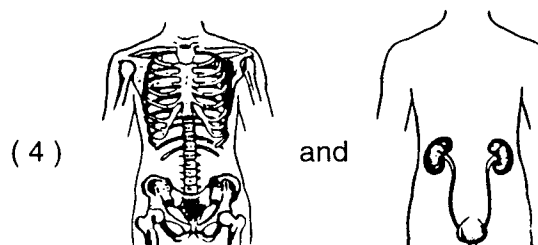
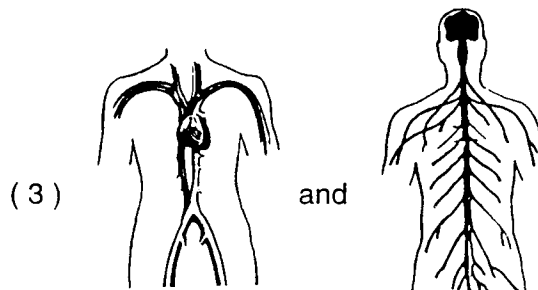
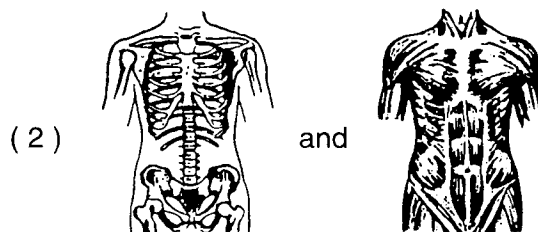
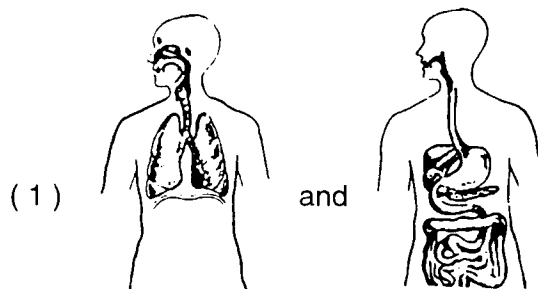
71 In a blood pressure reading, systolic pressure is most closely associated with the

- 1 contraction of structure G
- 2 flow of blood through structure E
- 3 relaxation of structure F
- 4 flow of blood through structure I

72 Which sequence represents normal blood flow between the two sides of the heart?

- (1) A → F → D → C → B
- (2) B → G → H → I → C
- (3) C → D → F → A → I
- (4) D → E → I → H → G

73 Which diagrams show organ systems that would be directly affected by the disorder known as tendinitis?



74 People who receive organ transplants sometimes produce antibodies in response to foreign proteins present in the organ of the donor. This reaction is an example of

- | | |
|----------------|---------------|
| 1 regeneration | 3 rejection |
| 2 clotting | 4 deamination |

75 The method used to determine blood type in the ABO blood group is based on the fact that anti-A antibodies will clump red blood cells that contain antigen A, and anti-B antibodies will clump red blood cells that contain antigen B. If anti-A antibodies are added to a drop of blood and no clumping occurs, the blood type is most likely

- | | |
|--------------|------------|
| (1) AB, only | (3) A or B |
| (2) A or AB | (4) B or O |

76 A branch of the nerve regulating the secretions of the stomach can be cut surgically. The decrease in hydrochloric acid secretion that would result from this procedure would be most helpful to an individual with

- | | |
|----------------|--------------|
| 1 diarrhea | 3 gallstones |
| 2 appendicitis | 4 ulcers |

77 A person with allergies may develop a rash and swollen eyes when exposed to certain substances. These symptoms are a reaction to

- 1 histamines produced as a result of an immune reaction
- 2 antigens produced as a result of passive immunity
- 3 phagocytosis, resulting in the destruction of body cells
- 4 an increase in the number of platelets

78 A disorder in which there is uncontrolled production of nonfunctional white blood cells in the bone marrow is known as

- | | |
|-------------|------------|
| 1 emphysema | 3 leukemia |
| 2 anemia | 4 angina |

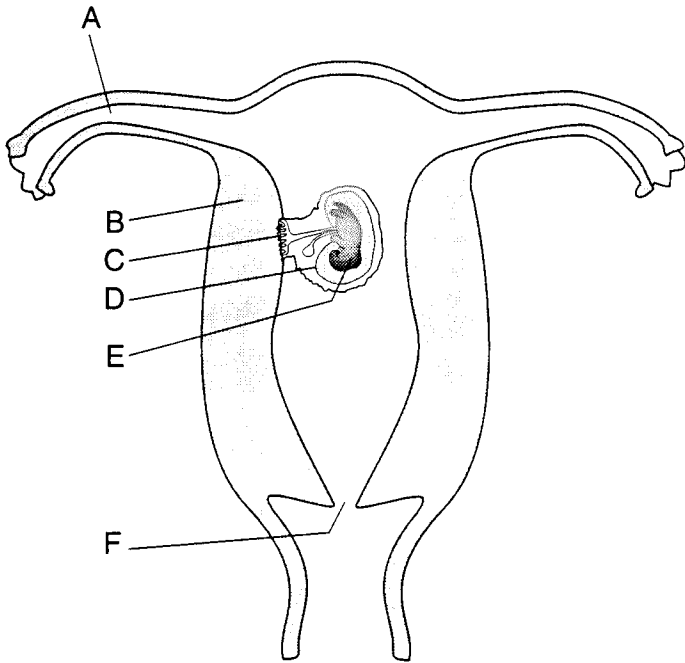
79 Which change in the human respiratory system is due to asthma?

- 1 an increase in lung capacity
- 2 a degeneration of alveoli
- 3 a constriction of the bronchial tubes
- 4 an obstruction of the nasal cavity

Group 3 — Reproduction and Development

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

Base your answers to questions 80 through 83 on the diagram below and on your knowledge of biology.



80 A structure formed from a combination of maternal and embryonic tissue is located at

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

81 The fertilization of the egg that produced structure E most likely occurred in structure

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

82 Preparation of structure B for the implantation of the embryo was regulated by the

- 1 cerebellum, pituitary, and testes
2 hypothalamus, pituitary, and ovaries
3 uterus, ovaries, and amnion
4 pituitary, amnion, and ovaries

83 The substance within structure D is known as

- 1 lymphatic fluid (3) yolk
2 plasma (4) amniotic fluid

Directions (84–86): For each phrase in questions 84 through 86, select the term, chosen from the list below, that is most closely related to that phrase. Then record its number on the separate answer paper.

Terms

- (1) Fertilization
(2) Gastrulation
(3) Differentiation
(4) Growth

84 Process during which the blastula indents

85 Results in an increase in cell number and cell size

86 Closely associated with the specialization of embryonic tissue

Directions (87–88): For each phrase in questions 87 and 88, select the human male reproductive structure, chosen from the list below, that is most closely associated with that phrase. Then record its number on the separate answer paper.

Human Male Reproductive Structures

- (1) Testis
(2) Scrotum
(3) Penis
(4) Urethra

87 Produces the hormone responsible for secondary sex characteristics in males

88 Considered a structural adaptation for internal fertilization

89 A malfunction of which structure would interfere most directly with the process of nutrition in a developing bird embryo?

- 1 allantois (3) chorion
2 yolk sac (4) fallopian tube

Group 4 — Modern Genetics

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

Directions (90–91): For each phrase in questions 90 and 91, 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) Phenylketonuria
- (2) Sickle-cell anemia
- (3) Tay-Sachs

- 90 Accumulation of fatty material in the nervous system
- 91 Results from the formation of abnormal hemoglobin _____

Base your answers to questions 92 and 93 on the chart below and on your knowledge of biology.

Messenger RNA (mRNA) Codes for Selected Amino Acids

Amino Acid	mRNA Code
Leucine	C-C-A
Arginine	C-G-A
Phenylalanine	U-U-U
Valine	G-U-U
Lysine	A-A-A

- 92 Which base sequence of a DNA molecule produces a codon on an mRNA molecule that will allow the amino acid arginine to be incorporated into a protein?
- (1) C-G-A
 - (2) G-C-T
 - (3) C-G-U
 - (4) G-C-U
- 93 Which amino acid will be carried to a ribosome by a transfer RNA molecule containing the triplet code A-A-A?
- 1 valine
 - 2 lysine
 - 3 leucine
 - 4 phenylalanine
-
- 94 The nitrogen bases found in DNA are represented by the letters
- (1) A, U, G, and C
 - (2) A, T, G, and C
 - (3) T, A, P, and C
 - (4) T, U, G, and C

95 Which illustration of a chromosomal change best represents a chromosome mutation known as a deletion?

- (1) ABCDEFG → ABCDEF
- (2) ABCDEFG → ABCDEFGH
- (3) ABCDEFG → ABEDCFG
- (4) ABCDEFG → ABCDEFGKMN

96 Which statement best describes the technique known as amniocentesis?

- 1 Some of the fluid surrounding the fetus is removed for analysis.
- 2 The length of the amnion is measured to predict the size of the baby at birth.
- 3 Photographs of chromosomes are developed, cut up, and arranged in homologous pairs.
- 4 The shape of red blood cells is studied microscopically.

97 A chromosomal alteration in which one or more pairs of homologous chromosomes fail to separate normally during meiotic cell division is known as

- 1 an addition
- 2 crossing-over
- 3 nondisjunction
- 4 translocation

98 In recent research, the DNA that codes for a different key enzyme was removed from each of three different species of soil bacteria. A new bacterium containing DNA for all three key enzymes was produced by

- 1 inbreeding
- 2 hybridization
- 3 mutagen screening
- 4 genetic engineering

99 The study of natural events that affect gene frequencies in sexually reproducing groups of organisms is known as

- 1 comparative biochemistry
- 2 population genetics
- 3 recombinant DNA technology
- 4 genetic counseling

Group 5 — Ecology

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

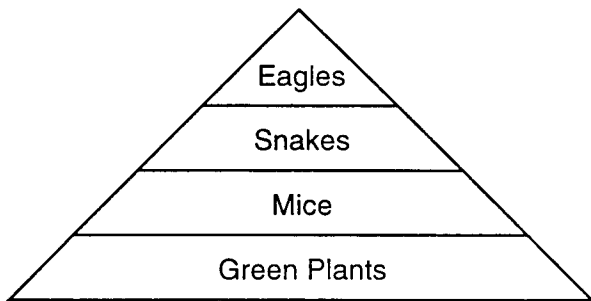
100 Which organisms would most likely have a predator-prey relationship?

- 1 tapeworm and dog 3 hawk and mouse
2 barnacle and whale 4 rabbit and grass

101 Eggs of a wasp species are deposited inside the body of a gypsy moth caterpillar. The wasp eggs hatch into larvae, which feed on and destroy the caterpillar. The relationship that exists between the wasp larvae and the caterpillar is known as

- 1 mutualism 3 commensalism
2 parasitism 4 saprophytism

102 In the food pyramid represented below, which level has the greatest biomass?



- 1 eagles 3 mice
2 snakes 4 green plants

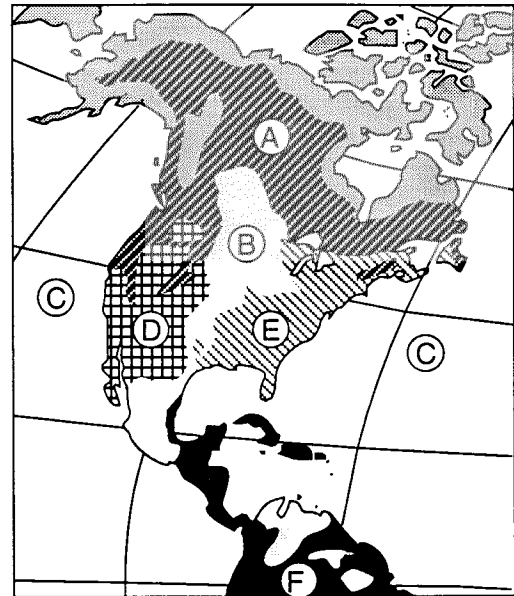
103 Which processes are involved in the water cycle?

- 1 respiration and photosynthesis, only
2 transpiration and excretion, only
3 respiration, photosynthesis, evaporation, and condensation, only
4 respiration, photosynthesis, transpiration, excretion, evaporation, and condensation

104 Which factor promotes competition between organisms in an ecosystem?

- 1 cycling of minerals
2 decomposition of organic matter
3 limited resources
4 presence of saprophytes

Base your answers to questions 105 through 107 on the diagram below, which shows the general location of some major biomes of the Western Hemisphere, and on your knowledge of biology.



105 The most stable biome is represented by letter

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

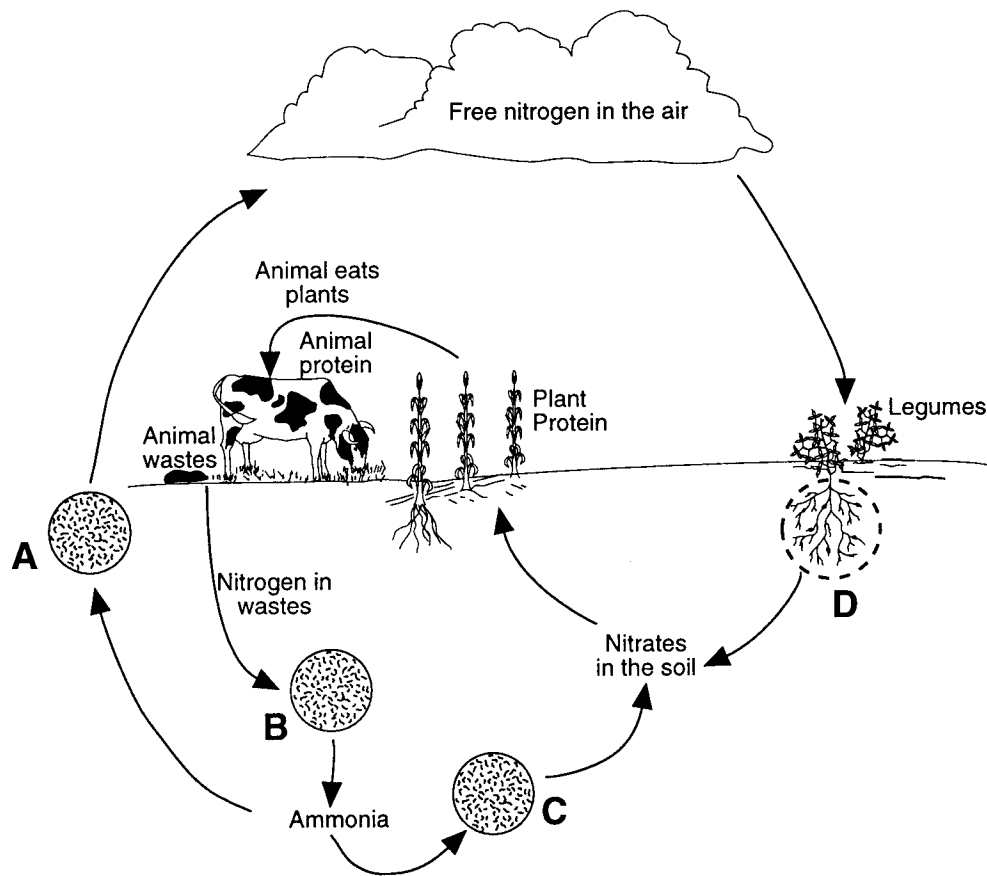
106 Which type of biome is indicated by letter E?

- 1 tundra 3 grassland
2 taiga 4 deciduous forest

107 The biome indicated by letter F is characterized by

- 1 heavy rainfall, broad-leaved plants, and monkeys
2 sparse rainfall, grasses, and leopards
3 variable rainfall, mosses, and caribou
4 heavy rainfall, conifers, and snakes

Base your answers to questions 108 and 109 on the diagram of a cycle below and on your knowledge of biology. Each circle represents the general location of different types of bacteria that play a role in this cycle.



108 Decomposer bacteria are indicated by letter

- (1) A
- (2) B

- (3) C
- (4) D

109 Denitrifying bacteria are indicated by letter

- (1) A
- (2) B

- (3) C
- (4) D

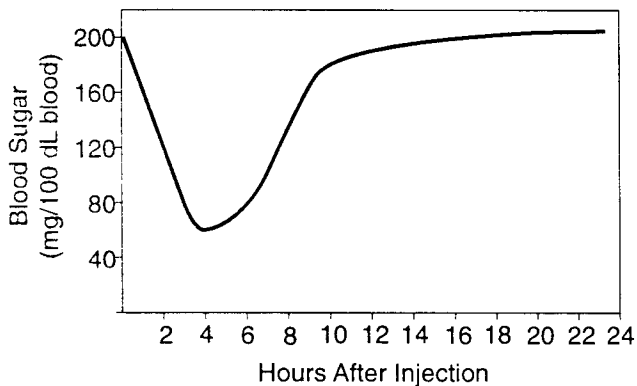
Part III

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 1

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

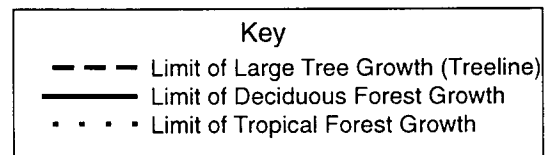
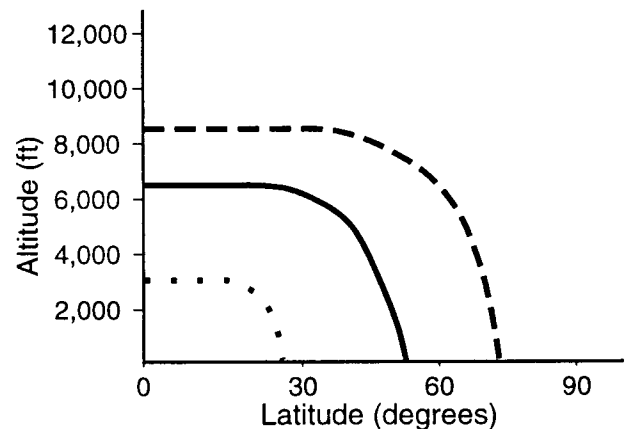
- 110 The graph below shows the concentration of sugar (glucose) in the blood of a human over a 24-hour period after an injection of insulin.



Which conclusion could be supported by these data?

- 1 Blood sugar concentration rises after the body uses up the injected insulin.
 - 2 Insulin raises blood sugar concentration in the liver.
 - 3 Blood sugar concentration remained constant in the blood throughout the 24-hour period.
 - 4 Insulin lowers blood sugar concentration in the muscle cells.
- 111 A student wanted to investigate the effect of varying concentrations of tryptophan on a bacterial culture. Several cultures of the same bacterial species were grown on media, each with a different amount of tryptophan. The cultures were then incubated at 37°C. At the end of 24 hours, the cultures were examined. As a control, the student should have used a culture that
- 1 contained no bacteria
 - 2 was incubated at 25°C
 - 3 contained no tryptophan
 - 4 was not incubated

- 112 The diagram below shows a relationship between altitude, latitude, and tree growth.



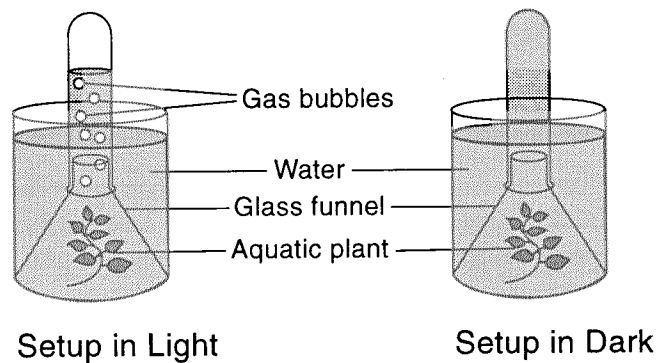
What is a valid inference that can be made based on this graph?

- 1 Deciduous trees cannot grow at an altitude of 5,000 feet.
- 2 The effects of increasing altitude and latitude on tree growth are similar.
- 3 There is less light available at 10,000 feet than at lower elevations.
- 4 Trees do not grow rapidly in the tropics.

113 For many years, scientists were uncertain about the function of repeated base sequences in DNA that did not code for proteins. Recently, investigations of plants indicated that the greater the number of specific repeated base sequences a plant species contains, the larger the plant will be. The Atlantic Giant pumpkin, which can reach a weight of almost 1,000 pounds, was found to contain a large number of these repeated DNA sequences. Similar findings were observed in other large plants. Which statement is *not* valid based on this information?

- 1 The Atlantic Giant pumpkin contains many repeated DNA sequences.
- 2 Scientists have only recently begun to understand the function of repeated DNA sequences.
- 3 Some regions of a DNA molecule code for proteins.
- 4 The findings reported for plants must also be true for animals.

114 The diagram below shows the setup of an experiment.



Using one or more complete sentences, state a problem that could be investigated using this experimental setup. You may use pen or pencil for your answer.

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 and data table below and on your knowledge of biology.

During a study of a colony of yeast cells, a student used a microscope to determine the number of yeast cells present at various times. The results are summarized in the data table below.

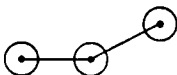
Data Table

Time (hours)	Number of Yeast Cells
0	5
1	10
2	18
3	45
4	30
5	8

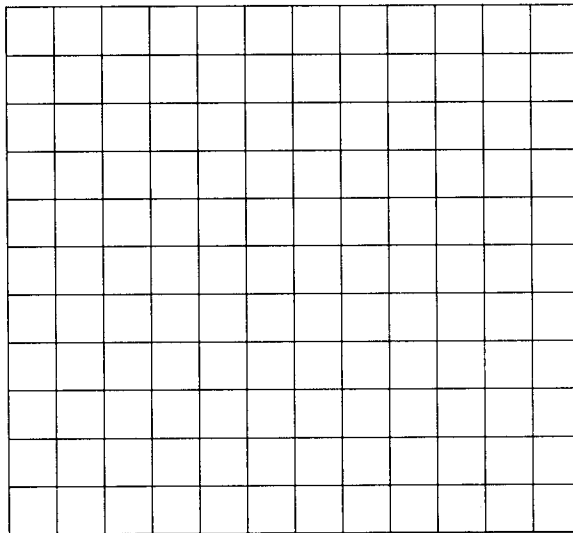
Directions (115–116): Using the information in the data table, construct a line graph on the grid provided *on your answer paper*, following the directions below. The grid on the next page is provided for practice purposes only. Be sure your final answer appears *on your answer paper*. You may use pen or pencil for your answer.

115 Mark an appropriate scale on each labeled axis.

116 Plot the data on the grid. Surround each point with a small circle and connect the points.

Example: 

Number of Yeast Cells



Time (hr)

117 Using one or more complete sentences, state one possible reason for the change in the number of yeast cells after the third hour. You may use pen or pencil for your answer.

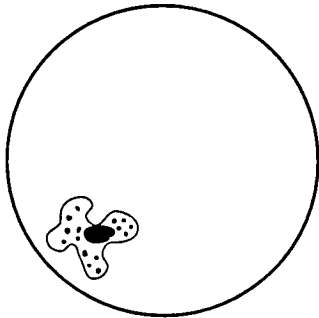
118 Approximately how many yeast cells were present after 2.5 hours? You may use pen or pencil for your answer.

119 Temperature is an environmental factor in a balanced aquarium. Using one or more complete sentences, describe one way this factor may change, *and* state one specific effect this change would have on the life in the aquarium. You may use pen or pencil for your answer.

Group 3

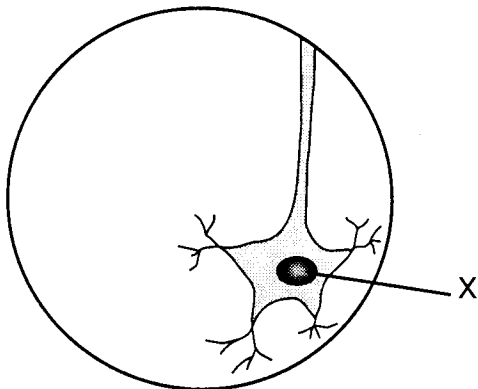
If you choose this group, be sure to answer questions 120–124.

- 120 A student observed an ameba in the field of view of a compound light microscope as shown in the diagram below. The same diagram appears on your answer paper.



On the diagram on your answer paper, draw an arrow to indicate the direction the ameba would move if the student moved the slide on the stage to the left and down. You may use pen or pencil for your answer.

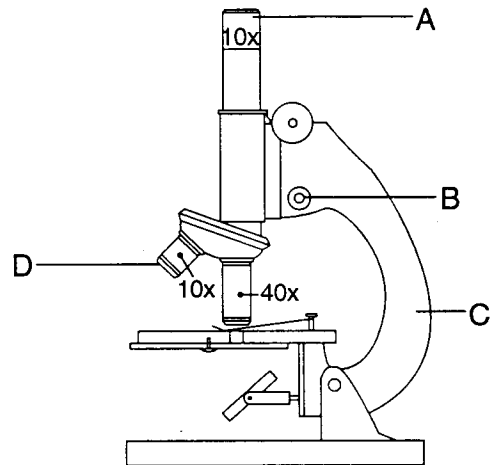
- 121 The diagram below represents the field of view of a compound light microscope.



If the diameter of the field of view is 0.5 millimeter, what is the approximate diameter of the structure labeled X in the cell?

- (1) 500 μm (3) 5 mm
(2) 50 mm (4) 50 μm

- 122 A student studied the upper layer of cells of a tissue sample under the high-power objective of the compound light microscope shown below.



Which part of the microscope should the student adjust to observe the cells in the lower layer of the sample?

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

- 123 A microscope with 10 \times and 40 \times objectives is used to scan a slide to locate a specimen. The largest field of vision would be provided by using the

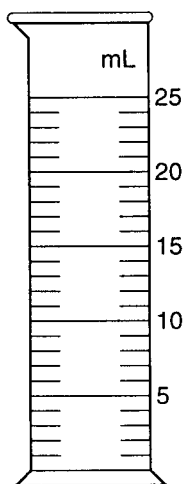
- (1) coarse adjustment
(2) widest diaphragm opening
(3) 10 \times objective
(4) 40 \times objective

- 124 Using one or more complete sentences, state the purpose of using stains in a wet-mount slide preparation. You may use pen or pencil for your answer.

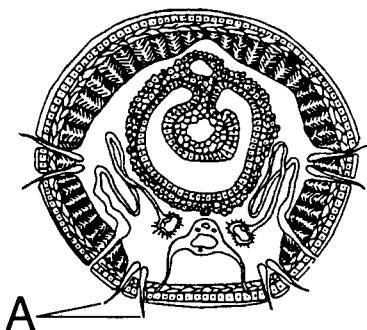
Group 4

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

- 125 On the diagram of the graduated cylinder *on your answer paper*, draw a meniscus to represent a water level of 6 milliliters. The diagram 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.



- 126 Which phrase best describes the structures labeled A in the cross section of an earthworm shown below?

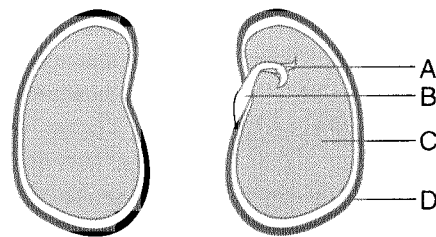


- 1 glands on the dorsal surface, which secrete mucus to keep the skin moist
- 2 nephridia in the anterior end, which function in the excretion of nitrogenous wastes
- 3 setae on the ventral surface, which function in the process of locomotion
- 4 flagella in the posterior end, which are involved in the process of ingestion

- 127 When an elodea leaf is placed in a concentrated salt solution, its cells lose water. When this process is observed with a compound light microscope, which organelle is more noticeable after the cells lose water?

- 1 cell membrane
- 2 mitochondrion
- 3 endoplasmic reticulum
- 4 ribosome

Base your answers to questions 128 and 129 on the diagram below and on your knowledge of biology. The diagram shows a bean seed that was soaked in water and then opened.



- 128 A positive test for the presence of starch in the seed could be obtained by

- 1 placing a drop of bromthymol blue on structure D
- 2 placing a drop of Lugol's iodine on structure C
- 3 heating structure A in a solution of methylene blue
- 4 heating structure B in a solution of simple sugar

- 129 A student removed a section of the bean seed and heated it in a test tube containing Benedict's solution. Using one or more complete sentences, describe one safety procedure the student should follow during this activity. You may use pen or pencil for your answer.

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.

It's Not Just A Tree!

Let's give Earth a long-lasting gift by planting some trees! Trees not only beautify the environment, but they also make important contributions to the ecosystem. Trees provide homes for a great variety of organisms, provide needed gases, and protect the soil from erosion. Trees not only absorb water, but they also release water into the environment. A single acre of maple trees puts 20,000 gallons of water back into the air each day. In addition to these benefits, trees provide many food products such as nuts, chocolate, cinnamon, and cola syrup.

A scientist researching an article on trees became aware of the "kinship of trees" in a forest when he discovered that the removal of one tree will affect other trees. Studies show that when trees are grown side by side, their roots are often joined by a fungus. If one young tree is in the shade, without sufficient light, it will get needed nutrients from its neighbor through the fungus. In other words, a forest is not simply a group of individual trees; it is a cooperative network of trees working together for survival.

Scientists have also discovered a chemical communication link among trees. For example, when a willow tree is attacked by webworms or tent caterpillars, it releases a chemical that alerts other trees. These "alerted" trees will increase the production of tannin in their leaves, which makes the leaves difficult for the webworms to digest.

Planting trees can make the surroundings more beautiful and more valuable and can make a significant contribution to the environment for future generations.

130 Which processes are most directly involved when a single acre of maple trees contributes 20,000 gallons of water daily to Earth's atmosphere?

- 1 transpiration and respiration
- 2 hydrolysis and excretion
- 3 photosynthesis and digestion
- 4 deamination and condensation

131 Two abiotic factors needed by trees for survival are

- 1 oxygen and tent caterpillars
- 2 fungus and soil
- 3 water and light
- 4 carbon dioxide and other trees

132 Which statement about the release of chemicals by willow trees is correct?

- 1 Willow trees secrete a chemical that kills all webworms.
- 2 Willow trees secrete a chemical that prevents the metamorphosis of webworms.
- 3 Willow trees are not known to use chemical messages in the control of insects.
- 4 Willow trees produce certain chemicals in response to an attack by webworms.

133 Using one or more complete sentences, explain the meaning of the phrase "kinship of trees." You may use pen or pencil for your answer.

- 134 On the diagram of the plant cell *on your answer paper*, draw an arrow pointing to a structure that would be present in this type of cell but not in a typical animal cell. Then write the name of the structure indicated by the arrow on the line provided. The point of the arrow should touch the structure. The diagram 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.



BIOLOGY

Thursday, August 13, 1998 — 12:30 to 3:30 p.m., only

ANSWER PAPER

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

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
64 1 2 3
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
101 1 2 3 4
102 1 2 3 4
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
108 1 2 3 4
109 1 2 3 4

**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
91 1 2 3
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 4
98 1 2 3 4
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 1 2 3 4

111 1 2 3 4

112 1 2 3 4

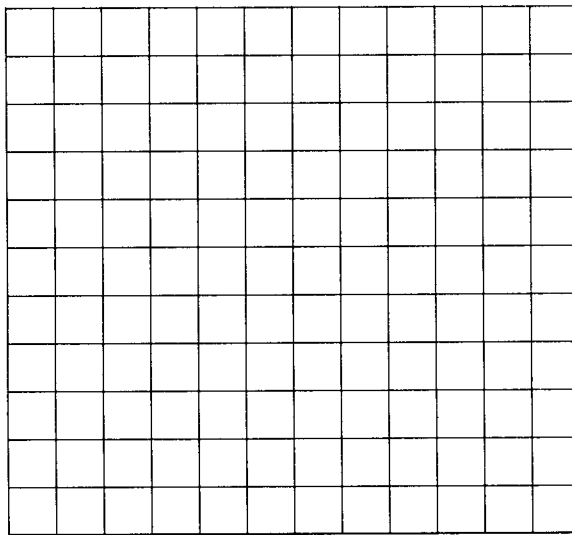
113 1 2 3 4

114 _____

Group 2

115 – 116

Number of Yeast Cells



Time (hr)

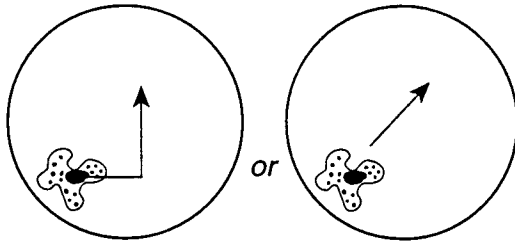
117 _____

118 _____

119 _____

Group 3

120



121 1 2 3 **X**

122 1 **X** 3 4

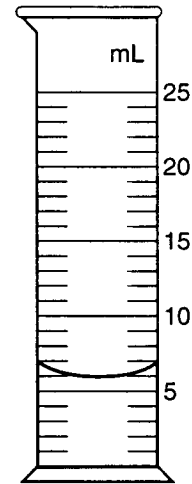
123 1 2 **X** 4

The answer below represents a sample response. Other complete-sentence responses are acceptable. Allow no partial credit.

124 Using stains makes certain organelles more visible.

Group 4

125



126 1 2 **X** 4

127 **X** 2 3 4

128 1 **X** 3 4

The answers below represent sample responses. Other complete-sentence responses are acceptable. Allow no partial credit.

129 The student should wear goggles.
or
Long hair should be tied back.

Group 5

130 **X** 2 3 4

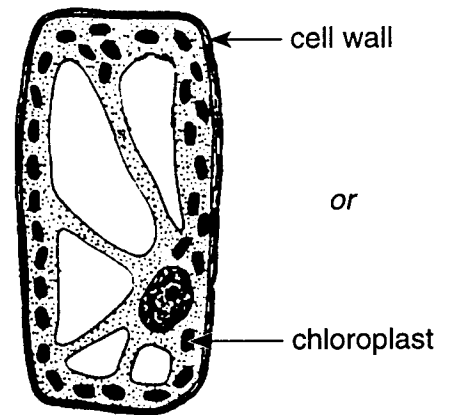
131 1 2 **X** 4

132 1 2 3 **X**

The answer below represents a sample response. Other complete-sentence responses are acceptable. Allow no partial credit.

133 The phrase "kinship of trees" means that trees work together.

134



cell wall or chloroplast