

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

# BIOLOGY

Wednesday, January 26, 2000 — 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 necessary for the survival of a species of ameba but is *not* necessary for the survival of an individual member of that species?

- 1 elimination of water by a contractile vacuole
- 2 transport of oxygen through the cell membrane
- 3 ingestion of nutrients
- 4 process of binary fission

2 Which term is defined as all the chemical reactions that are required to sustain life?

- 1 metabolism
- 2 regulation
- 3 nutrition
- 4 synthesis

3 A classification scheme is shown below.

Classification	Examples
Kingdom — Animal	dolphin, house cat, songbird, lynx, wolf, earthworm, butterfly, hydra
Phylum — Chordata	dolphin, house cat, songbird, lynx, wolf
Genus — <i>Felis</i>	house cat, lynx
Species — <i>domestica</i>	house cat

This classification scheme indicates that the house cat is most closely related to the

- 1 dolphin
- 2 songbird
- 3 lynx
- 4 wolf

4 A structure that performs a specialized function within a cell is known as

- 1 a tissue
- 2 an organelle
- 3 an organ
- 4 a system

5 Which organism is considered an exception to the cell theory because it has a noncellular structure?

- 1 alga
- 2 bacterium
- 3 virus
- 4 moss

6 Which chemical compound makes up the greatest percentage of a protozoan?

- 1 nucleic acid
- 2 glucose
- 3 fatty acid
- 4 water

7 Which factor does *not* alter the rate of hydrolysis of maltose?

- (1) temperature of the environment of the reaction
- (2) pH of the environment of the reaction
- (3) size of the substrate molecule
- (4) number of enzyme molecules present

8 One immediate cause of a decrease in the rate of photosynthesis is a reduction in the availability of

- 1 carbon dioxide
- 2 carbon monoxide
- 3 hydrogen
- 4 nitrogen

9 The function of the gastric caecum in a grasshopper is most similar to the function of the

- 1 nephridium in an earthworm
- 2 pancreas in a human
- 3 anal pore in a paramecium
- 4 nerve net in a hydra

10 Which structure is most directly responsible for maintaining homeostasis in all cells?

- 1 chloroplast
- 2 cell membrane
- 3 centriole
- 4 cell wall

11 Vascular tissue that transports water in leaves connects directly to

- 1 meristems in the root tip
- 2 pistils in the flower
- 3 root hairs in the epidermis
- 4 xylem in the stem

12 Which two organisms represented below are heterotrophic?



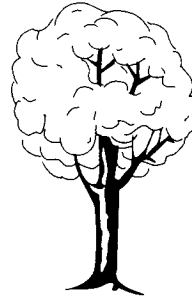
A



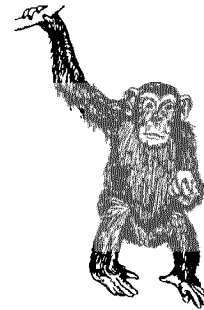
B



C



D



E

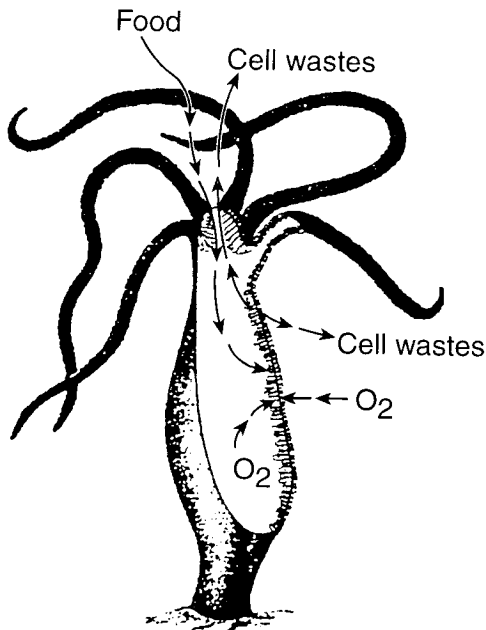
(1) A and B

(2) B and C

(3) C and E

(4) D and E

13 Which three processes are indicated by the arrows in the diagram below?

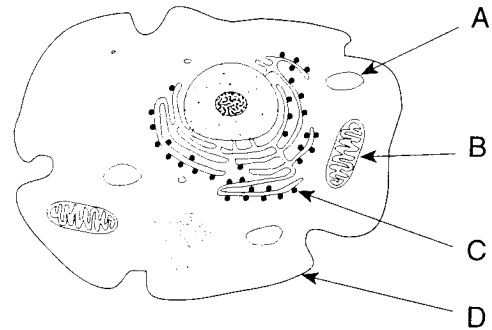


- 1 ingestion, diffusion, and excretion
- 2 ingestion, digestion, and egestion
- 3 cyclosis, meiosis, and mitosis
- 4 diffusion, active transport, and cyclosis

14 A biologist analyzed the liquid in the nephridia of earthworms and the liquid in the nephrons of humans. The liquid found in both organisms was most likely composed of water containing

- 1 sugar and uric acid
- 2 sugar and ammonia
- 3 salts and urea
- 4 salts and amino acids

15 Which letter in the diagram below indicates the structure that is most closely associated with excretion?



(1) A

(2) B

(3) C

(4) D

16 Which process is correctly paired with the waste it produces?

- 1 respiration — methane
- 2 protein metabolism — ammonia
- 3 dehydration synthesis — carbon dioxide
- 4 hydrolysis — urea

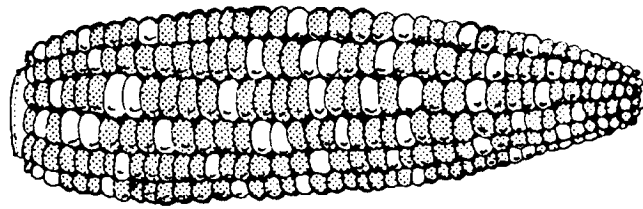
17 In grasshoppers and humans, locomotion is accomplished by means of

- 1 the interaction of muscles and jointed appendages
- 2 jointed chitinous appendages
- 3 a cartilaginous endoskeleton
- 4 the interaction of muscles and an exoskeleton

- 18 During aerobic respiration, the chemical energy of a glucose molecule is gradually released, producing 36 ATP and
- (1)  $\text{NH}_3$  and  $\text{O}_2$                       (3)  $\text{H}_2\text{O}$  and  $\text{O}_2$   
 (2)  $\text{NH}_3$  and  $\text{CO}_2$                       (4)  $\text{H}_2\text{O}$  and  $\text{CO}_2$
- 19 In trees, shrubs, and other woody plants, the exchange of  $\text{CO}_2$  and  $\text{O}_2$  with the environment may occur through structures known as
- 1 spiracles                                      3 lenticels  
 2 anthers                                        4 rhizoids
- 20 Small hairs on the legs of certain insects have the ability to detect chemicals. These hairs function as
- 1 receptors                                      3 stimuli  
 2 effectors                                        4 responses
- 21 Which organism has a primitive brain, a ventral nerve cord, and antennae?
- 1 bryophyte                                      3 chordate  
 2 grasshopper                                    4 jellyfish
- 22 After several days near a window, a house plant began to grow toward the window. This growth pattern occurred because auxins
- 1 prevent the growth of cells on the light side of the plant  
 2 stimulate the growth of cells on the dark side of the plant  
 3 are activated when they are exposed to light  
 4 are distributed evenly throughout the plant stem
- 23 Which type of digestion occurs in the mouth when an individual chews a piece of bread?
- 1 mechanical digestion, only  
 2 chemical digestion, only  
 3 both mechanical and chemical digestion  
 4 neither mechanical nor chemical digestion
- 24 Which structure is lined with a ciliated mucous membrane that warms, moistens, and filters air?
- 1 pharynx                                        3 epiglottis  
 2 alveolus                                        4 nasal cavity
- 25 Which transport structures have specialized regions for filtering out bacteria and dead cells?
- 1 arteries                                        3 veins  
 2 capillaries                                      4 lymph vessels
- 26 In humans, the ureter transports urine from the
- 1 blood to the kidney  
 2 liver to the kidney  
 3 kidney to the urinary bladder  
 4 urinary bladder to outside the body
- 27 If a motor neuron involved in a reflex arc is damaged, which event in that arc is *least* likely to occur?
- 1 contraction of a muscle  
 2 stimulation of an interneuron  
 3 reception of a stronger stimulus by the sense organ  
 4 secretion of a neurotransmitter by the sensory neuron
- 28 Which system is most closely associated with the production of regulatory chemicals by glands?
- 1 nervous                                        3 circulatory  
 2 respiratory                                      4 endocrine
- 29 The inelastic connective tissue that attaches a muscle in the lower leg to a heel bone is known as
- 1 a tendon                                        3 cartilage  
 2 a ligament                                      4 epidermis
- 30 Which process results in offspring with a genetic makeup identical to that of the parent?
- 1 fusion of gametes  
 2 vegetative propagation  
 3 external fertilization  
 4 meiotic cell division
- 31 The uncontrolled division of certain body cells, which then invade the surrounding tissues and interfere with the normal functioning of the body, is known as
- 1 cancer                                        3 cleavage  
 2 regeneration                                    4 oogenesis

- 32 Corals reproduce by forming multicellular outgrowths from the body wall that detach and develop into independent organisms. Which statement most closely describes this form of reproduction in another organism?
- 1 Molds reproduce by sporulation.
  - 2 Hydras reproduce by budding.
  - 3 Paramecia reproduce by binary fission.
  - 4 Maple trees reproduce by seed formation.
- 33 Which reproductive process is correctly paired with the structure in which it occurs?
- 1 meiosis — liver
  - 2 fertilization — gonad
  - 3 gametogenesis — testis
  - 4 pollination — stamen
- 34 A McIntosh apple tree branch was grafted to an Ida Red apple tree. The fruit produced by the newly grafted piece will be
- (1) McIntosh apples, only
  - (2) Ida Red apples, only
  - (3) 50% McIntosh apples and 50% Ida Red apples
  - (4) apples that are a blend of McIntosh and Ida Red apples
- 35 Why is the release of 2,000 to 10,000 eggs by a female salmon during one season considered a favorable reproductive adaptation?
- 1 External fertilization increases the chance of sperm reaching the eggs.
  - 2 Overproduction decreases the rate of embryo development.
  - 3 The species is declining, so the reproductive rate has increased.
  - 4 Unfavorable environmental conditions may destroy gametes.
- 36 Animals that produce embryos that are born small and relatively immature and must complete their development in a pouch are known as
- 1 hermaphrodites
  - 2 placental mammals
  - 3 marsupials
  - 4 invertebrates
- 37 The brightly colored, highly scented flowers on a rosebush are an adaptation for
- 1 wind pollination
  - 2 insect pollination
  - 3 the production of spores
  - 4 nutrition for developing rose embryos
- 38 Using the results of his experiments with pea plant crosses, Gregor Mendel discovered
- 1 the principles of dominance, segregation, and independent assortment
  - 2 that pea plants develop mutations after exposure to radiation
  - 3 intermediate inheritance and gene linkage
  - 4 that DNA is involved in the inheritance of dominant traits
- 39 In a certain variety of chicken, the genes for black feather color and the genes for white feather color are codominant. This variety of chicken will most likely have
- 1 three possible phenotypes for feather color
  - 2 white feather color, only
  - 3 only two genotypes for feather color
  - 4 black feather color, only
- 40 In fruit flies, red eye color ( $R$ ) is dominant and white eye color ( $r$ ) is recessive. The allele for eye color is carried on the X-chromosome. Which cross would most likely produce 50% white-eyed males and 50% red-eyed males?
- (1)  $X^R X^R \times X^R Y$
  - (2)  $X^R X^R \times X^r Y$
  - (3)  $X^R X^r \times X^r Y$
  - (4)  $X^r X^r \times X^R Y$
- 41 A mutation may be passed on to future generations if it occurs within specialized cells of the
- 1 stomach
  - 2 liver
  - 3 pancreas
  - 4 ovary
- 42 An example of a mutagenic agent is
- 1 an amino acid
  - 2 ultraviolet radiation
  - 3 acetylcholine
  - 4 maltase

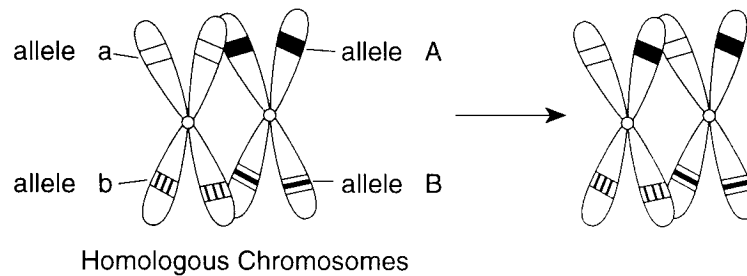
- 43 Kernel color in corn is a trait determined by two alleles. The dominant allele ( $P$ ) produces a purple color, and the recessive allele ( $p$ ) produces a yellow color. The diagram below shows an ear of corn produced by crossing two corn plants. The shaded kernels are purple, and the unshaded ones are yellow.



The yellow kernels can best be described as

- |                       |                        |
|-----------------------|------------------------|
| 1 homozygous dominant | 3 hybrid               |
| 2 heterozygous        | 4 homozygous recessive |

- 44 The results of a genetic process are represented in the diagram below.



Which process most likely produced these results?

- 1 chromosomal mutation during mitosis
- 2 nondisjunction during meiosis
- 3 independent assortment during mitosis
- 4 crossing-over during meiosis

- 45 A DNA nucleotide may contain

- 1 deoxyribose, cytosine, and a lipid
- 2 deoxyribose, thymine, and a phosphate group
- 3 ribose, uracil, and a polypeptide
- 4 ribose, adenine, and thymine

- 46 Fossils of an extinct species of giant armadillo were found to be similar to a smaller species of armadillo presently inhabiting the same region. This similarity could best be explained on the basis of

- 1 evolution from older forms
- 2 inheritance of acquired characteristics
- 3 use and disuse
- 4 the heterotroph hypothesis

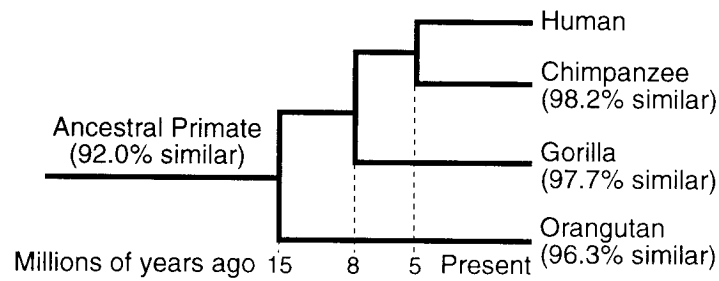
- 47 A study of the position and shape of the bones in the forelimbs of a flying squirrel, a bat, and a beaver showed that the beaver and the flying squirrel appear to be most closely related. This determination was most likely based on a study in the field of comparative

- |              |                |
|--------------|----------------|
| 1 embryology | 3 anatomy      |
| 2 cytology   | 4 biochemistry |

- 48 By simulating conditions thought to have existed on primitive Earth, Stanley Miller found that these conditions could result in the formation of

- |                         |                  |
|-------------------------|------------------|
| 1 organic compounds     | 3 plant tissues  |
| 2 radioactive materials | 4 animal embryos |

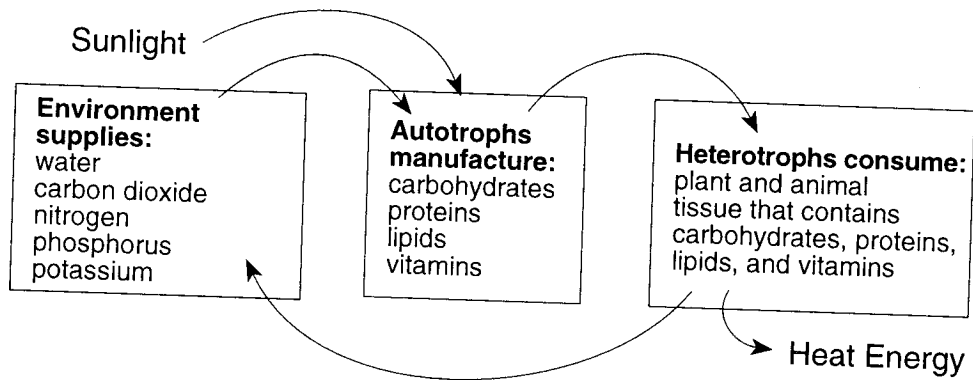
- 49 The diagram below shows a comparison of nitrogen base sequences in the DNA of some organisms to those of a human.



According to this diagram, humans may be most closely related to the

- |                     |             |
|---------------------|-------------|
| 1 ancestral primate | 3 gorilla   |
| 2 chimpanzee        | 4 orangutan |
- 
- 50 August Weismann conducted a series of experiments involving the removal of the tails from several generations of mice. Which concept of evolution did he help to *disprove*?
- 1 natural selection
  - 2 gradualism
  - 3 inheritance of acquired characteristics
  - 4 geographic isolation
- 51 Modern evolutionary theory consists of the concepts of Darwin modified by knowledge concerning
- 1 overpopulation
  - 2 the genetic basis of variation
  - 3 survival of the fittest
  - 4 competition
- 52 According to the heterotroph hypothesis, which gas was added to the environment by the first heterotrophs?
- |            |                  |
|------------|------------------|
| 1 nitrogen | 3 water vapor    |
| 2 oxygen   | 4 carbon dioxide |
- 53 Which human activity would most likely result in the addition of an organism to the endangered species list?
- 1 cover cropping
  - 2 use of pollution controls
  - 3 use of erosion controls
  - 4 habitat destruction
- 54 An aquarium ecosystem is shown below.
- 
- A community in this aquarium consists of the
- 1 plants and gravel
  - 2 fish, water, and snails
  - 3 fish, plants, and snails
  - 4 water and gravel
- 55 The first organism in most natural food chains is
- |                |                  |
|----------------|------------------|
| 1 an herbivore | 3 photosynthetic |
| 2 a decomposer | 4 carnivorous    |
- 56 Which factor is *not* necessary for an ecosystem to be self-sustaining?
- 1 a constant source of energy
  - 2 living systems that incorporate energy into organic molecules
  - 3 a cycling of materials between organisms and their environment
  - 4 an equal number of producers and consumers

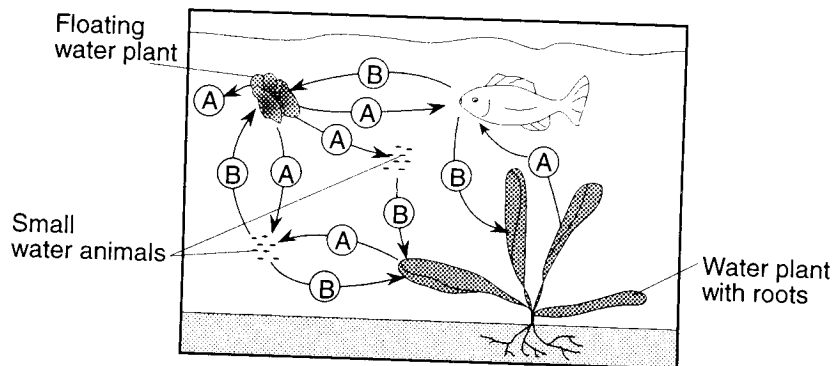
57 The diagram below provides some information concerning an ecosystem.



Which title is most appropriate for the diagram?

- 1 Energy Flow and Material Cycles in an Ecosystem
- 2 Evolution in an Ecosystem
- 3 Succession in an Ecosystem
- 4 The Water Cycle in an Ecosystem

58 The diagram below shows an example of interdependence among aquatic organisms. During the day, the organisms either use or give off substance A or B, as shown by the arrows.



Which substances are represented by A and B?

- (1) A represents oxygen and B represents carbon dioxide.
- (2) A represents oxygen and B represents carbohydrates.
- (3) A represents nitrogen and B represents carbon dioxide.
- (4) A represents carbon dioxide and B represents oxygen.

59 The chart below lists four groups of factors relating to an ecosystem.

Group A	Group B	Group C	Group D
Sunlight	Sunlight	Sunlight	Sunlight
Green plants	Climate	Green plants	Rainfall
Rainfall	Rainfall	Rainfall	Consumers
Consumers	Minerals	Producers	Producers
Oxygen	Gases	Carbon dioxide	Water

Which group contains only abiotic factors?

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



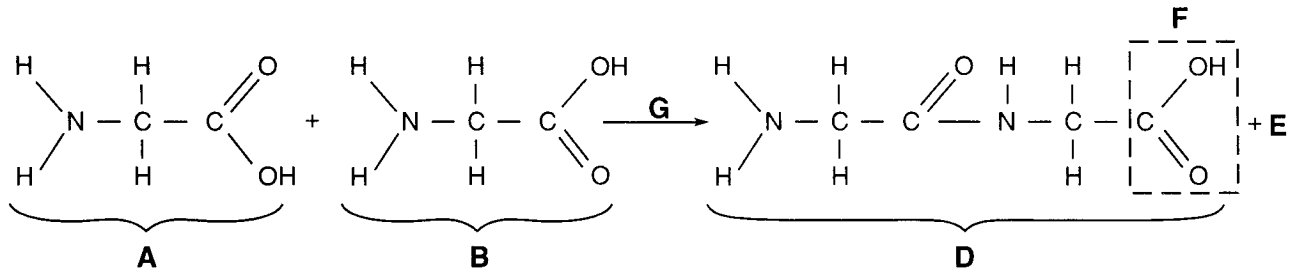
## Part II

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 63 on the chemical reaction represented below and on your knowledge of biology.



60 Amino acids are indicated by letters

- |                           |                           |
|---------------------------|---------------------------|
| (1) <i>A</i> and <i>B</i> | (3) <i>G</i> and <i>D</i> |
| (2) <i>A</i> and <i>G</i> | (4) <i>B</i> and <i>D</i> |

62 Letter *E* represents a molecule of

- |                  |            |
|------------------|------------|
| 1 oxygen         | 3 glycerol |
| 2 carbon dioxide | 4 water    |

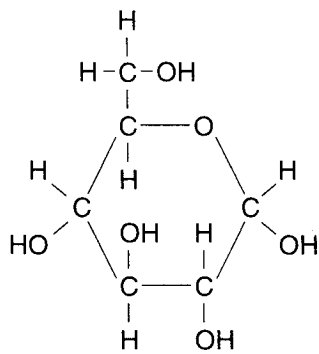
61 This reaction is an example of

- 1 hydrolysis
- 2 aerobic respiration
- 3 dehydration synthesis
- 4 deamination

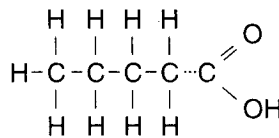
63 The portion of the molecule in box *F* is known as

- |                    |                    |
|--------------------|--------------------|
| 1 an amino group   | 3 a polymer        |
| 2 a carboxyl group | 4 a monosaccharide |

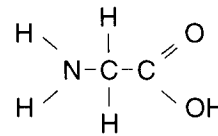
64 The diagrams below represent four different molecules.



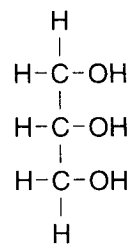
A



B



C

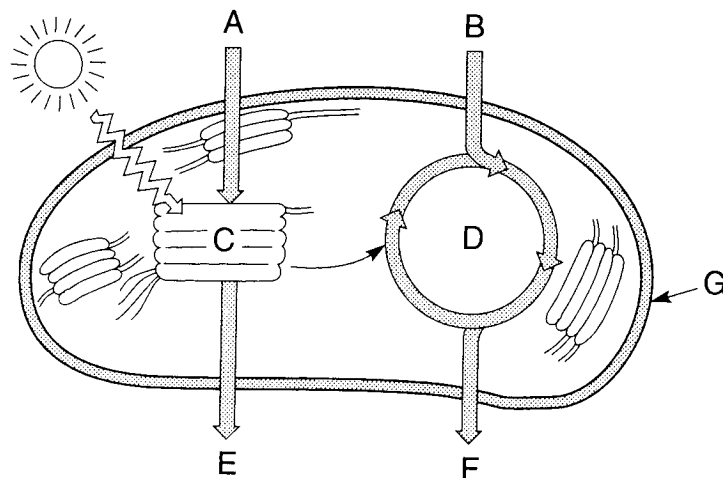


D

Which two diagrams represent the building blocks of lipids?

- |                           |                           |
|---------------------------|---------------------------|
| (1) <i>A</i> and <i>B</i> | (3) <i>C</i> and <i>D</i> |
| (2) <i>B</i> and <i>D</i> | (4) <i>A</i> and <i>C</i> |

Base your answers to questions 65 through 67 on the diagram of a chloroplast below and on your knowledge of biology.



65 The process of photolysis in the grana occurs at letter

- (1) *E*
- (2) *G*
- (3) *C*
- (4) *D*

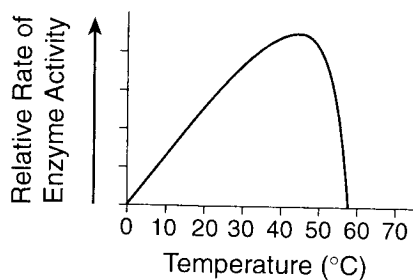
67 The dark reactions in the stroma are represented by letter

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

66 Carbon dioxide is represented by letter

- (1) *E*
- (2) *B*
- (3) *C*
- (4) *F*

68 Which statement is a valid conclusion based on the information in the graph below?



- 1 The maximum rate of human digestion occurs at about 45°C.
- 2 The maximum rate of human respiration occurs at about 57°C.
- 3 Temperature can influence the action of an enzyme.
- 4 Growth can be controlled by enzyme action.

69 What are the end products of the hydrolysis of a polysaccharide?

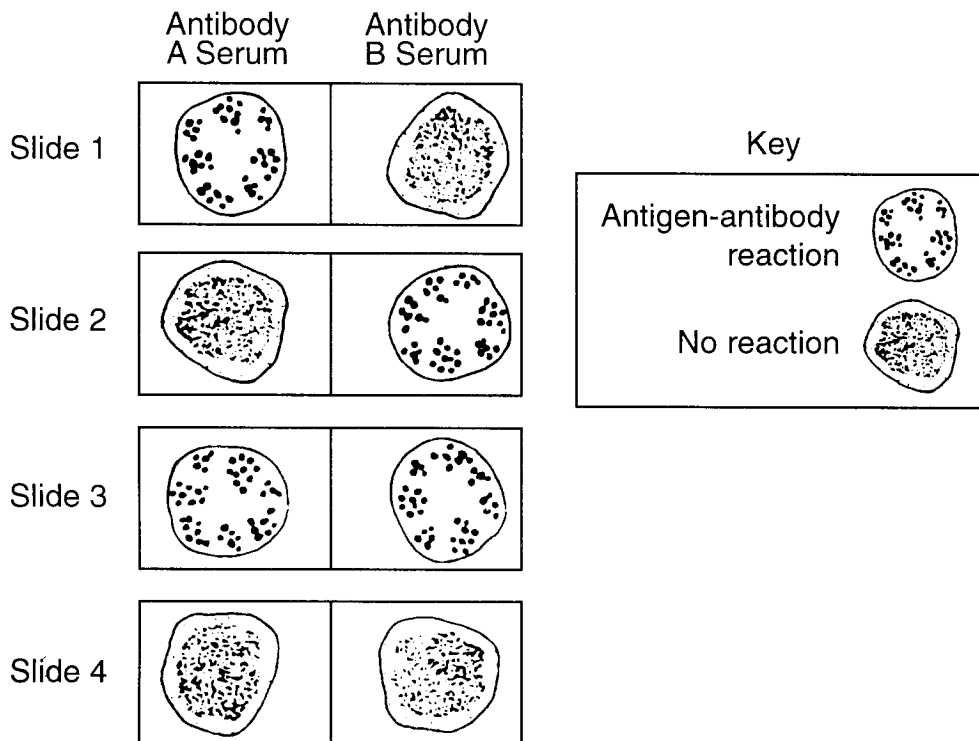
- 1 simple sugars
- 2 amino acids
- 3 fatty acids
- 4 nucleotides

**Group 2 — Human Physiology**

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

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

A technician needed to determine the blood type of four individuals. To do this, the technician set up four slides, one for each individual. The technician placed a drop of antibody A serum and a drop of antibody B serum on each of four slides. The technician mixed a drop of blood from each individual into the anti-A and anti-B serum on a different slide. The results of the four tests are shown below.



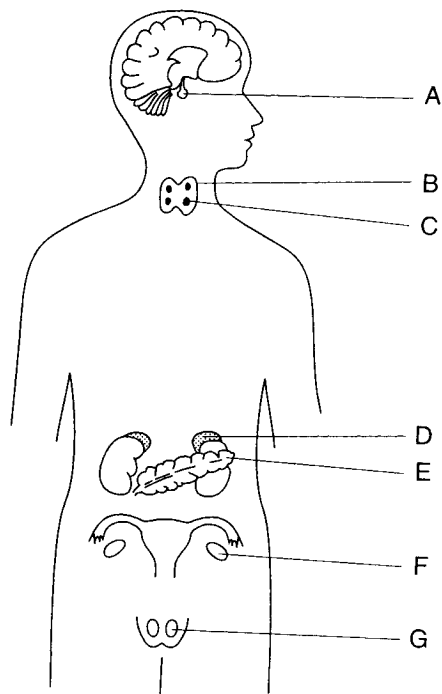
70 Which slide contains blood from the individual who has antigen A, but not antigen B?

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

71 Which slide contains blood from the individual who carries two recessive alleles for blood type?

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

Base your answers to questions 72 and 73 on the diagram below, which represents endocrine glands of both human sexes, and on your knowledge of biology.



72 The secretion of hormones from gland *F* is regulated by hormones secreted from gland

- (1) *A*
- (2) *B*
- (3) *G*
- (4) *D*

73 The level of glucose in the blood is regulated by secretions from glands

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

74 Pollen grains often stimulate an allergic response that produces

- 1 antigens
- 2 antibodies
- 3 plasma
- 4 platelets

*Directions (75–76):* For each phrase in questions 75 and 76, select the malfunction, chosen from the list below, that is best described by that phrase. Then record its number on the separate answer paper.

*Malfunction*

- (1) Stroke
- (2) Polio
- (3) Cerebral palsy
- (4) Meningitis

75 Congenital disease characterized by a disturbance of motor function

76 Inflammation of the membranes surrounding the central nervous system

77 The flow of blood to and from the lungs is referred to as

- 1 pulmonary circulation
- 2 systemic circulation
- 3 autonomic circulation
- 4 somatic circulation

78 A source of roughage in the human diet is supplied by certain

- 1 saturated lipids
- 2 complete proteins
- 3 complex carbohydrates
- 4 nucleic acids

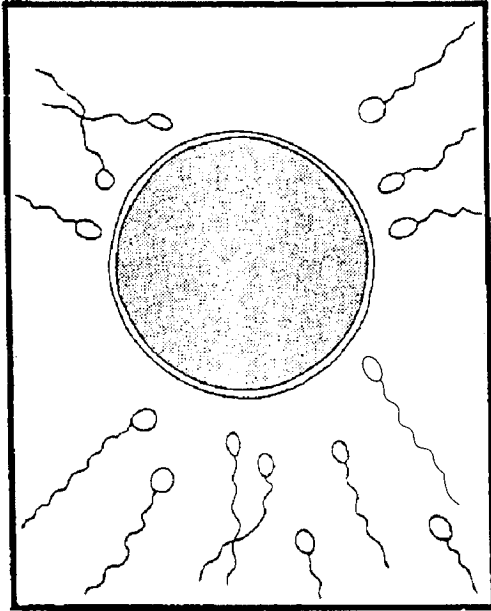
79 Which set of symptoms would most likely lead to a diagnosis of asthma?

- 1 enlargement and degeneration of the alveoli
- 2 constriction of the bronchial tubes and wheezing
- 3 inflammation and swelling of the epiglottis
- 4 constriction of the nasal cavity and watery eyes

### Group 3 — Reproduction and Development

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

Base your answers to questions 80 through 82 on the diagram below, which suggests an event in human reproduction, and on your knowledge of biology.



80 In humans, which process would normally *not* occur within the first two months after the completion of the process suggested in the diagram?

- |                |                   |
|----------------|-------------------|
| 1 mitosis      | 3 menstruation    |
| 2 implantation | 4 differentiation |

81 In humans, the process suggested in the diagram usually occurs in the

- |            |           |
|------------|-----------|
| 1 follicle | 3 vagina  |
| 2 uterus   | 4 oviduct |

82 Which statement concerning all of the cells shown in the diagram is correct?

- 1 They contain the same amount of cytoplasm.
- 2 They normally contain the monoploid number of chromosomes.
- 3 They were formed by the process of mitosis.
- 4 They were formed by asexual reproduction.

Base your answers to questions 83 through 85 on the chart below, which contains descriptions of embryonic membranes in a developing chicken egg, and on your knowledge of biology.

Membrane	Description
A	has blood vessels that carry food to the developing embryo
B	serves as a storage site for uric acid
C	protects the embryo from physical shock

83 Which membrane is represented by letter A?

- |             |            |
|-------------|------------|
| 1 allantois | 3 chorion  |
| 2 amnion    | 4 yolk sac |

84 The membrane represented by letter B is most closely associated with the process of

- |              |             |
|--------------|-------------|
| 1 excretion  | 3 nutrition |
| 2 regulation | 4 synthesis |

85 The membrane represented by letter C is the

- |             |            |
|-------------|------------|
| 1 allantois | 3 chorion  |
| 2 amnion    | 4 yolk sac |

86 In which organ are female primary sex cells produced?

- |           |            |
|-----------|------------|
| 1 ovary   | 3 testis   |
| 2 urethra | 4 placenta |

87 A third cell layer in the human embryo is formed during the

- |                  |                  |
|------------------|------------------|
| 1 zygote stage   | 3 gastrula stage |
| 2 blastula stage | 4 cleavage stage |

88 Which adaptations do most reptiles have for fertilization and development?

- 1 internal fertilization and internal development
- 2 internal fertilization and external development
- 3 external fertilization and internal development
- 4 external fertilization and external development

89 Which hormone stimulates and controls the development of secondary sex characteristics in human males?

- 1 estrogen
  - 2 progesterone
  - 3 insulin
  - 4 testosterone
-

### Group 4 — Modern Genetics

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

*Directions (90–92):* For each phrase in questions 90 through 92, select the genetic disorder, *chosen from the list below*, that is most closely associated with that phrase. Then record its *number* on the separate answer paper.

#### *Genetic Disorders*

- (1) Tay-Sachs
- (2) Phenylketonuria
- (3) Sickle-cell anemia
- (4) Down syndrome

90 Changes in speech patterns and mental retardation due to the presence of an extra chromosome

91 A decrease in the ability of the blood to carry oxygen due to the presence of abnormal hemoglobin

92 Inability of the body to manufacture the enzyme needed to metabolize a specific amino acid

---

93 A single change in the sequence of nitrogenous bases in a DNA molecule would most likely result in

- 1 crossing-over
- 2 polyploidy
- 3 nondisjunction of chromosomes
- 4 a gene mutation

94 Which base is normally used in the synthesis of RNA but *not* in the synthesis of DNA?

- 1 adenine
- 2 uracil
- 3 cytosine
- 4 guanine

95 A sequence of three nitrogenous bases in a messenger-RNA molecule is known as a

- 1 codon
- 2 gene
- 3 polypeptide
- 4 nucleotide

Base your answers to questions 96 and 97 on the information below and on your knowledge of biology.

Some geneticists are suggesting the possibility of transferring some of the genes that influence photosynthesis from an efficient variety of crop plant to a less efficient crop plant to produce a new variety with improved productivity.

96 To produce this new variety, the project would most likely involve

- 1 amniocentesis
- 2 genetic screening
- 3 genetic engineering
- 4 inbreeding

97 Which technique would most likely be used to produce large numbers of genetically identical offspring from this new variety of plant?

- 1 cloning
- 2 karyotyping
- 3 cross-pollination
- 4 chromatography

---

98 According to the Hardy-Weinberg principle, the gene pool of a population will remain stable if

- 1 no mutations occur
- 2 the population is small
- 3 individuals migrate into and out of the population
- 4 nonrandom mating occurs by artificial selection

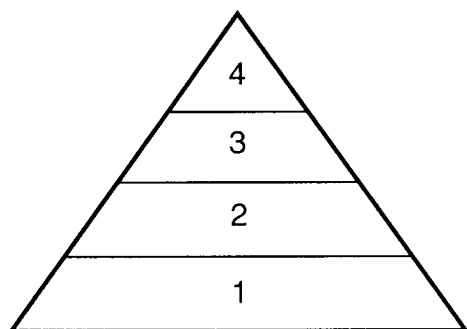
99 In the synthesis of proteins, what is the function of messenger-RNA molecules?

- 1 They act as a template for the synthesis of DNA.
- 2 They carry information that determines the sequence of amino acids.
- 3 They remove amino acids from the nucleus.
- 4 They carry specific enzymes for dehydration synthesis.

## Group 5 — Ecology

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

Base your answers to questions 100 and 101 on the biomass pyramid below of a community containing a variety of producers and consumers and on your knowledge of biology.



- 100 Primary consumers would be found at
- 1 levels 1 and 2                      3 level 3, only  
 2 level 2, only                        4 levels 2 and 3
- 101 At which level would organisms capable of autotrophic nutrition be found?
- (1) 1                                        (3) 3  
 (2) 2                                        (4) 4
- 
- 102 Some characteristics of four different biomes are represented in the chart below.

Biome	Characteristic Plant Life	Characteristic Animal Life
A	succulent plants	kangaroo rat, lizard
B	grasses	antelope, bison
C	deciduous trees	fox, deer
D	conifers	moose, black bear

Which biome is characterized by moderate precipitation, cold winters, warm summers, and climax plants that lose their leaves in the winter?

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

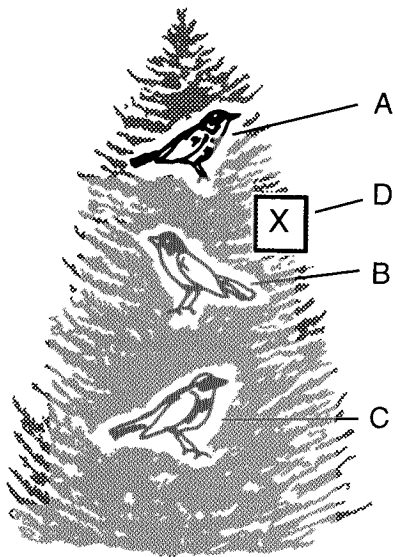
Base your answers to questions 103 through 105 on the chart below and on your knowledge of biology.

Stage	Dominant Flora
A	None (freshly plowed land)
B	Annual grasses
C	Various shrubs
D	Birch and cherry trees
E	Beech-maple forest

- 103 Which stage represents a pioneer community?
- (1) A                                        (3) C  
 (2) B                                        (4) D
- 104 The replacement of stage B by stage C and the replacement of stage C by stage D in a particular location is known as
- 1 exploitation  
 2 cover cropping  
 3 ecological succession  
 4 punctuated equilibrium
- 105 In New York State, which fauna would most likely be associated with stage E?
- 1 caribou                                    3 leopards  
 2 prairie dogs                            4 gray squirrels
- 
- 106 Which statement does *not* describe a marine biome?
- 1 It is the most stable aquatic environment.  
 2 It has very few species of fauna.  
 3 It absorbs and holds large quantities of solar heat.  
 4 It contains a relatively constant supply of nutrients.



- 107 The diagram below represents a tree containing three different species of warbler, *A*, *B*, and *C*. Each species occupies a different niche.



A fourth species, *D*, which has the same environmental requirements as species *B*, enters the tree at point *X*. Members of species *B* will most likely

- 1 live in harmony with species *D*
- 2 move to a different level and live with species *A* or species *C*
- 3 stay at that level but change their diet
- 4 compete with species *D*

- 108 A symbiotic relationship exists between two organisms of different species. If only one organism benefits from the relationship and the other is not harmed, the relationship is known as

- |                |                |
|----------------|----------------|
| 1 commensalism | 3 parasitism   |
| 2 mutualism    | 4 saprophytism |

- 109 Nodules on the roots of legumes contain

- 1 nitrogen-fixing bacteria, which help produce nitrates
- 2 denitrifying bacteria, which produce amino acids
- 3 bacteria that release uric acid into the soil
- 4 bacteria that produce protein for absorption by plants

### 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.

Base your answers to questions 110 through 113 on the information and data table below and on your knowledge of biology.

One milliliter of a solution containing an even distribution of a species of bacterium was spread on the surface of a nutrient medium in each of five culture dishes. The nutrient medium in each dish was the same, except for pH. The dishes were then incubated at 37°C for 24 hours. The number of bacterial colonies in each dish was then counted, and the results are represented in the data table below.

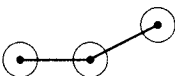
Data Table

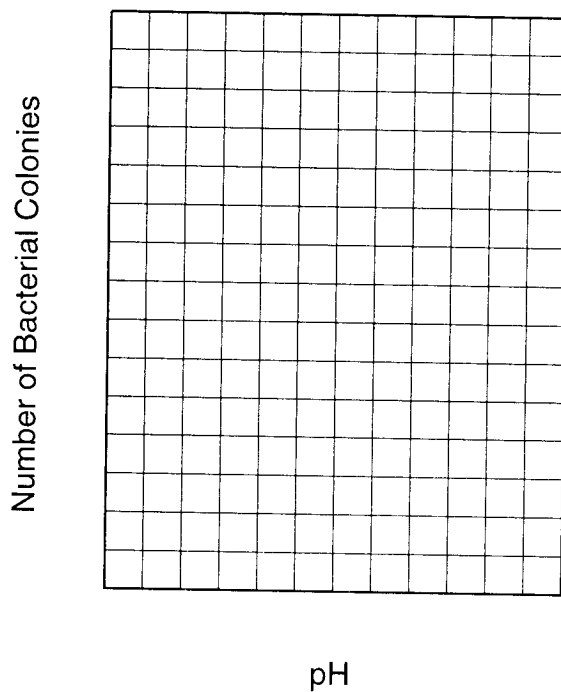
pH of Nutrient Medium	Number of Bacterial Colonies on Nutrient Medium
5	10
6	50
7	60
8	70
9	5

*Directions (110–111):* 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.

110 Mark an appropriate scale on each labeled axis.

111 Plot the data for the number of bacterial colonies on the grid. Surround each point with a small circle and connect the points.

Example: 

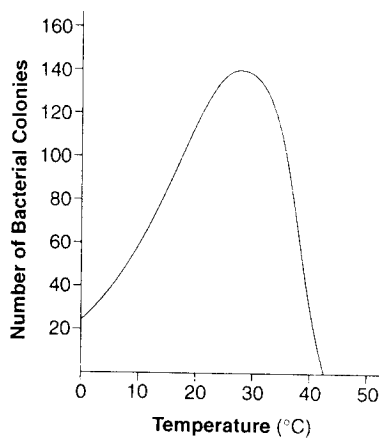


- 112 The limiting factor in this investigation is the
- (1) pH of the nutrient medium
  - (2) species of bacterium in each culture dish
  - (3) color of the colonies of bacteria
  - (4) amount of nutrient medium in each culture dish

113 Using one or more complete sentences, state a conclusion that relates the number of colonies of this species of bacterium to pH. You may use pen or pencil for your answer.

---

114 The graph below shows the results of an investigation in which an unknown species of bacteria was cultured for 24 hours. With the exception of temperature, all conditions influencing the growth of this bacterium remained constant.



What is the experimental variable in this investigation?

- |                          |                      |
|--------------------------|----------------------|
| 1 time                   | 3 number of colonies |
| 2 size of each bacterium | 4 temperature        |
-

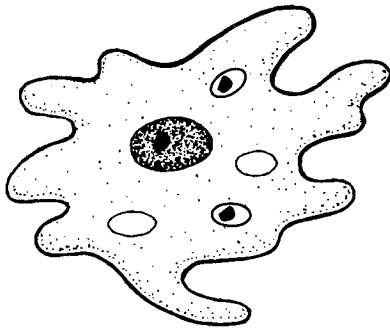
## Group 2

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

115 A student used a light microscope to observe a cell under low power. After the student switched to high power and attempted to focus, the cell was no longer visible. What was most likely the cause of the disappearance of the cell?

- 1 The diaphragm was open while the student observed the cell under low power.
- 2 The distance between the specimen and the objective lens decreased after the student switched to high power.
- 3 The student focused the eyepiece before observing the cell under high power.
- 4 The cell was not in the center of the field of view when the student observed it under low power.

116 A unicellular organism is represented in the diagram below.



On the copy of the diagram *on your answer paper*, draw an arrow to the structure where deoxyribonucleic acid is synthesized. The point of the arrow must touch the structure. You may use pen or pencil for your answer.

117 The ocular of a compound light microscope has a magnification of  $10\times$ , and the low-power objective and high-power objective lenses have magnifications of  $10\times$  and  $30\times$ , respectively. If the diameter of the low-power field measures 1,500 micrometers, the diameter of the high-power field will measure

- |                       |                         |
|-----------------------|-------------------------|
| (1) 100 $\mu\text{m}$ | (3) 500 $\mu\text{m}$   |
| (2) 300 $\mu\text{m}$ | (4) 4,500 $\mu\text{m}$ |

118 When preparing a wet mount of onion cells, a student put a drop of Lugol's iodine solution on the slide. Lugol's iodine solution was applied in order to

- 1 prevent air bubbles
- 2 make cell structures more visible
- 3 increase the magnification
- 4 increase respiration in the cells

119 A student is viewing a protist under the low-power objective of a compound light microscope. Using one or more complete sentences, describe an adjustment the student would need to make to see the protist clearly after switching from low power to high power. Include the name of the part of the microscope that would be used to make the adjustment. You may use pen or pencil for your answer.

### Group 3

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

120 An environmental change causes the contractile vacuoles of a paramecium to stop functioning, while most of the other cell structures appear to be unaffected. Which environmental change would most likely produce this result?

- (1) temperature change from 20°C to 25°C
- (2) pH change from 7.0 to 6.5
- (3) large decrease in the amount of light
- (4) slight increase in salt concentration in the environment

121 A student is studying the internal structures of an earthworm. To examine a cross section of the part of the earthworm's digestive tract that is specialized for mechanical digestion, the student should

- 1 observe the ventral side of the crop with a compound light microscope
- 2 make a longitudinal cut through the mouth and view the result with a dissecting microscope
- 3 make a vertical cut through the gizzard and view the result with a dissecting microscope
- 4 observe a thin section of the intestine with a compound light microscope

122 A student added 10 mL of a yeast suspension and 10 mL of 30°C water to each of two test tubes. Five grams of sugar was then added to one of the test tubes. Both test tubes were gently swirled to mix the contents, and then the test tubes were placed in a warm water bath for 15 minutes. The student made observations of any bubbles that formed in the test tubes and recorded the data in a table.

This experiment was most likely carried out to investigate the

- 1 effect of sugar on a metabolic activity of yeast
- 2 effect of temperature on a metabolic activity of yeast
- 3 solubility of yeast in water at 30°C
- 4 solubility of sugar in a yeast suspension

123 A biologist plans to spend a year investigating the mating behavior of a certain species of frog. To make meaningful observations, the biologist should observe

- 1 a small number of frogs in their natural habitat
- 2 a large number of frogs in their natural habitat
- 3 several groups of frogs maintained in different temperatures in the laboratory
- 4 several groups of frogs maintained on different diets in the laboratory

124 When a fish opens and closes its mouth, water is forced over the gills, which act as the sites of gas exchange. Four teams of students investigated the effect of temperature on the rate of mouth openings in a certain species of fish. Proper experimental procedure was followed throughout the investigation. The results are shown in the data table below.

Data Table

	Number of Mouth Openings per Minute			
TEAM	30°C	28°C	26°C	24°C
Team 1	105	105	103	102
Team 2	109	105	103	101
Team 3	112	105	102	96
Team 4	104	103	103	100
Team Average	107.5	104.5	102.8	99.8

Using one or more complete sentences, predict what will most likely happen to the rate of respiration in this species of fish if the temperature is decreased to 22°C. You may use pen or pencil for your answer.

## Group 4

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

Base your answers to questions 125 through 128 on the passage below and on your knowledge of biology.

### Ibuprofen Helps Patients with Cystic Fibrosis

A faulty version of the CFTR gene causes the disease cystic fibrosis (CF). This gene is found in 1 in 25 Caucasians in the United States. A person who inherits a copy of this gene from each parent develops CF. Thick mucus builds up in the lungs of CF patients, leaving them vulnerable to infections. Over time, this repeated cycle of illness and inflammation causes structural damage to the lungs of the patient.

In a recent study, the common pain reliever ibuprofen significantly reduced lung damage caused by cystic fibrosis. This study included 85 CF patients between the ages of 5 and 39. Half of those participating in the study were given a tablet containing ibuprofen, and the other half were given a placebo (a tablet containing no ibuprofen). Ibuprofen, taken along with other treatments, most benefited CF patients between the ages of 5 and 13. Patients taking ibuprofen suffered less inflammation of the bronchial tubes. Lung deterioration in the children taking ibuprofen was nearly 90% slower than expected. Among those patients taking ibuprofen, lung capacity declined by only 2%, while those taking the placebo experienced a decline of 16%.

Researchers recommend that doctors begin the new therapy with their cystic fibrosis patients. However, the treatment involves taking large doses of ibuprofen, which can cause serious side effects, including stomach and kidney damage. The researchers warn people with cystic fibrosis not to take ibuprofen without talking with their doctors first.

Thirty years ago, most CF patients died before the age of 5. Today, many CF patients live into their 30's. A new drug for CF, DNase, was approved in 1994. Trials are also being done using gene therapy to correct the faulty gene found in cystic fibrosis patients. Since ibuprofen therapy delays the progression of the disease, it is hoped that more patients will be able to benefit from gene therapy when it becomes available for general use.

- 125 Which statement regarding the use of ibuprofen in the treatment of cystic fibrosis is correct?
- 1 Lung deterioration in individuals taking ibuprofen was about 16% slower than in those taking the placebo.
  - 2 Although initially promising, problems with stomach and kidney damage have made most doctors unwilling to prescribe ibuprofen for the treatment of cystic fibrosis.
  - 3 Large doses of ibuprofen can be dangerous, but under the care of a doctor the benefits of ibuprofen for individuals with cystic fibrosis can be significant.
  - 4 The most significant reduction in the swelling of the bronchi due to ibuprofen therapy occurred in individuals 15 to 35 years of age.
- 126 A valid conclusion that can be drawn from this information is that
- 1 ibuprofen is now considered the drug of choice, replacing DNase in treating cystic fibrosis
  - 2 because of ibuprofen, gene therapy and the use of DNase are no longer considered effective ways to treat cystic fibrosis
  - 3 ibuprofen, with its serious side effects, is too dangerous to use in the treatment of cystic fibrosis
  - 4 in combination with other drugs, ibuprofen reduces lung damage and slows the progress of cystic fibrosis

127 Cystic fibrosis results when an individual is

- 1 homozygous for the faulty CFTR gene
- 2 heterozygous for the faulty CFTR gene
- 3 given an overdose of ibuprofen
- 4 exposed to a person with this disease

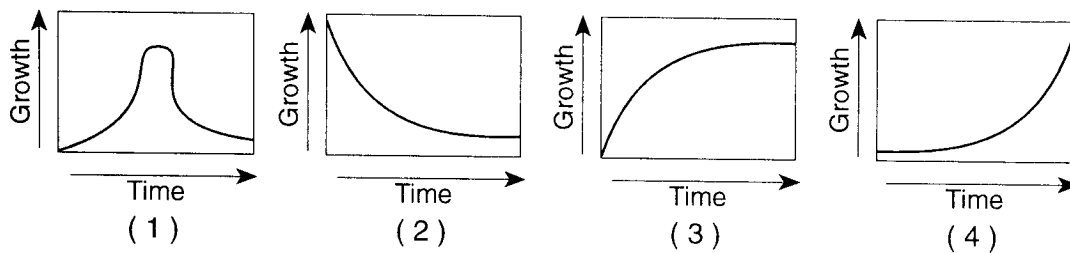
128 Using one or more complete sentences, state one possible result of the buildup of mucus in the lungs of individuals with cystic fibrosis. You may use pen or pencil for your answer.

129 A single protist was placed in a large test tube containing nutrient broth. The tube was then kept at room temperature for 24 hours. Samples from the tube were observed periodically during the 24 hours, using the low power of a compound light microscope. The data are summarized in the table below.

**Data Table**

Age of the Population in Hours	Number of Protists in the Population
0	1
6	2
8	3
10	4
13	8
16	16
18	32
20	64
22	128
24	256

Which graph best represents the data?



### Group 5

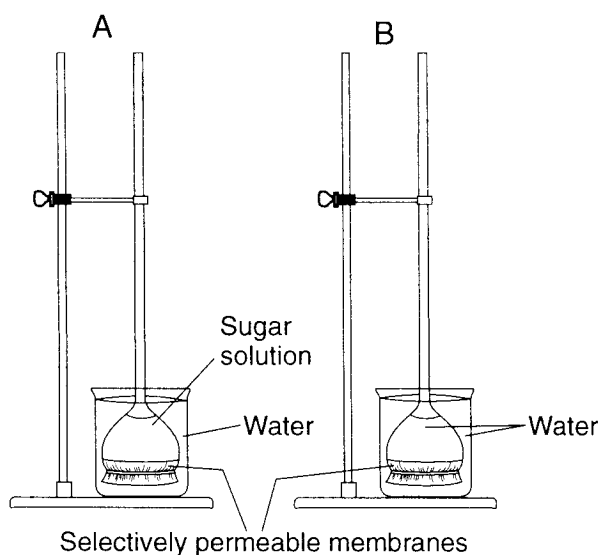
If you choose this group, be sure to answer questions 130–134.

130 A student wanted to determine if plants grow better under blue light than under yellow light. The student obtained two genetically identical plants of the same size and placed each in a growth chamber. One plant was grown in blue light, and the other was grown in yellow light. All other experimental conditions were the same. The student measured the height of the plants after 2 weeks. To test the reliability of the data, the student repeated the experiment with two plants of the same species that were not genetically related to the first set of plants. The results were similar to those of the first experiment.

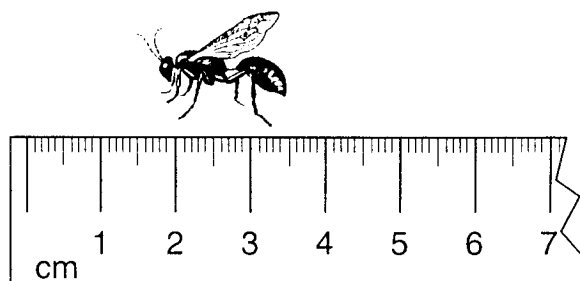
To make a valid conclusion regarding these results, the student should

- 1 repeat the experiment using other species of plants
- 2 conduct another experiment using only blue light
- 3 repeat the experiment using different variables
- 4 publish the results of the experiments

131 Record the letter that indicates the apparatus that serves as the control for the experiment in the diagram below. You may use pen or pencil for your answer.



132 The diagram below shows a wasp positioned next to a centimeter ruler.



What is the approximate length of a wing of this wasp?

- (1) 10 mm
- (2) 1.4 cm
- (3) 3.5 cm
- (4) 35 mm

133 A blue solution turns yellow when it is exposed to a weak acid. A small amount of this blue solution was added to a test tube of water containing an aquatic snail. The color of the water in the tube changed from blue to yellow after 30 minutes. A possible explanation for this color change is that the

- 1 body of the snail is slightly basic
- 2 snail is absorbing carbon dioxide from the water
- 3 excretions of the snail have affected the pH of the water
- 4 snail ingested some of the blue solution

134 A student is heating a test tube containing a crushed cracker and Benedict's solution. The student is wearing safety goggles and a laboratory apron. Using one or more complete sentences, state one other safety precaution the student should observe. You may use pen or pencil for your answer.



**BIOLOGY**

Wednesday, January 26, 2000 — 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	37
58	64	28	36
57	63	27	36
56	62	26	35
55	61	25	34
54	60	24	33
53	59	23	32
52	59	22	31
51	58	21	30
50	57	20	29
49	56	19	28
48	55	18	27
47	54	17	26
46	53	16	25
45	52	15	25
44	51	14	23
43	50	13	22
42	49	12	20
41	48	11	18
40	48	10	17
39	47	9	15
38	46	8	13
37	45	7	12
36	44	6	10
35	43	5	8
34	42	4	7
33	41	3	5
32	40	2	3
31	39	1	2
30	38	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
- 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 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 4
- 98 1 2 3 4
- 99 1 2 3 4

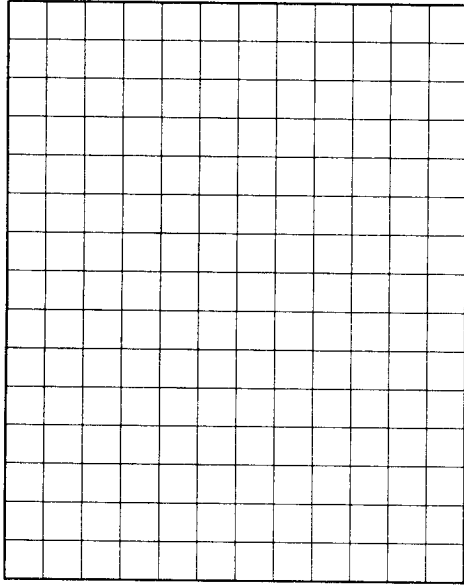
Part III (15 credits)

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

Group 1

110 – 111

Number of Bacterial Colonies



pH

112 1 2 3 4

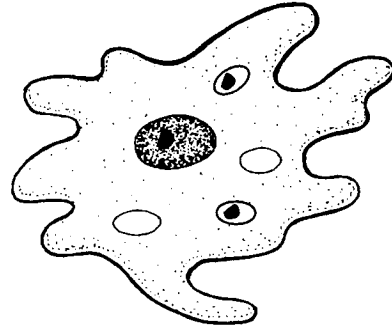
113 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

114 1 2 3 4

Group 2

115 1 2 3 4

116



117 1 2 3 4

118 1 2 3 4

119 \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**Group 3**

120 1 2 3 4

121 1 2 3 4

122 1 2 3 4

123 1 2 3 4

124 \_\_\_\_\_  
\_\_\_\_\_

**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 \_\_\_\_\_

132 1 2 3 4

133 1 2 3 4

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