

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

BIOLOGY

Thursday, August 12, 1999 — 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 Enzyme molecules are produced by the life function known as

- 1 egestion
- 2 respiration

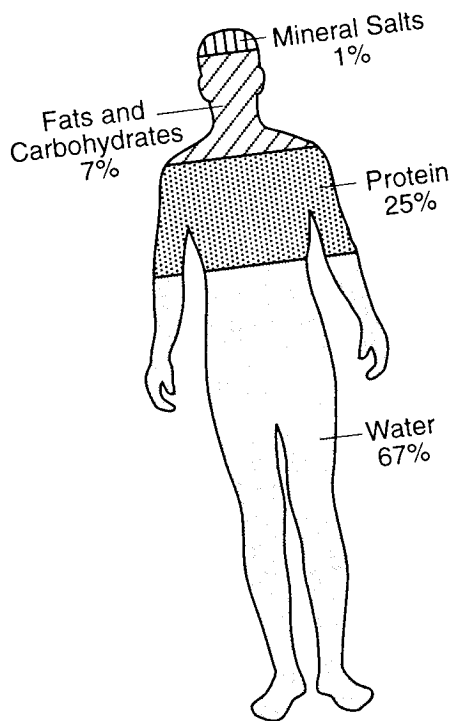
- 3 growth
- 4 synthesis

2 Which classification category contains the greatest number of different types of organisms?

- 1 kingdom
- 2 phylum

- 3 genus
- 4 species

3 The diagram below is a pictograph representing the estimated chemical composition of the human body.



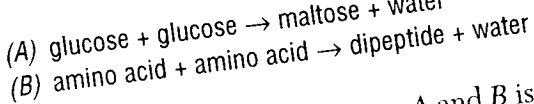
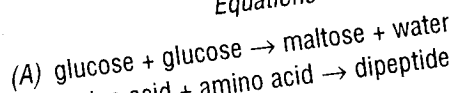
What percentage of the human body is composed of inorganic material?

- (1) 25%
- (2) 32%

- (3) 68%
- (4) 74%

4 The equations below represent two biochemical processes, A and B.

Equations



Which statement about processes A and B is correct?

- 1 Process A requires energy, but process B does not.
- 2 Process B requires enzymes, but process A does not.
- 3 Processes A and B are examples of hydrolysis.
- 4 Processes A and B are examples of dehydration synthesis.

5 In a changing external environment, an organism must be able to maintain relatively constant internal conditions. This maintenance of a stable internal environment is known as

- 1 transport
- 2 metabolism

- 3 homeostasis
- 4 nutrition

6 Most recently, biologists have increased their knowledge of cell structure and organelles due to the

- 1 discovery of the dissection microscope
- 2 invention of the 40x lens
- 3 invention of the compound light microscope
- 4 development of the electron microscope

7 Which activity completes an enzyme-controlled reaction?

- 1 synthesis of coenzymes by enzymes
- 2 initial formation of an enzyme-substrate complex
- 3 separation of the enzyme and the product of the reaction
- 4 destruction of the enzyme

8 Before the storage products of photosynthesis can be used by a plant, they must first be

- 1 converted to simpler molecules by intracellular digestion
- 2 digested in a specialized digestive system
- 3 broken down by extracellular digestion
- 4 hydrolyzed in multinucleated filaments

9 The secretion of hydrolytic enzymes by the salivary glands of the grasshopper is an adaptation for

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

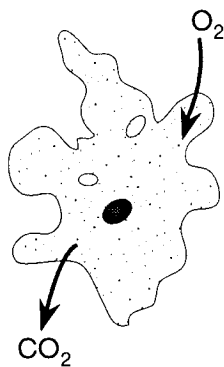
10 Transport of molecules within animal cells is assisted by a system of internal membranes that make up the

- 1 endoplasmic reticulum
- 2 mitochondria
- 3 ribosomes
- 4 chloroplast

11 The formation of lactic acid in human muscle cells is most closely associated with

- 1 muscle fatigue
- 2 protein synthesis
- 3 an increase in alcohol consumption
- 4 an increase in glucose production

12 Which process accomplishes the movement of gases illustrated by the arrows in the diagram below?



- 1 transpiration
- 2 diffusion
- 3 phagocytosis
- 4 osmosis

13 Which letter or letters in the chart below represent an animal that could be a coelenterate?

Animal	Type of Digestive Structure	Method of Digestion
A	Tubelike, with two openings	Extracellular, only
B	Saclike cavity	Intracellular and extracellular
C	Food vacuole	Intracellular, only

- (1) A, only
- (2) B
- (3) C, only
- (4) A and C

14 Which woody plant structure possesses vascular tissue and lenticels?

- 1 root
- 2 seed
- 3 stem
- 4 flower

15 Oxygen transport in humans involves the bonding of oxygen with

- 1 white blood cells
- 2 platelets
- 3 hormones
- 4 hemoglobin molecules

16 As a result of their metabolic activities, many organisms produce harmful substances. These substances are eliminated by the process of

- 1 ingestion
- 2 secretion
- 3 pinocytosis
- 4 excretion

17 Which statement correctly describes the recycling of a nontoxic waste by an organism?

- 1 Ammonia resulting from protein metabolism is used by an earthworm to synthesize amino acids.
- 2 Water molecules resulting from respiration are used by a desert animal to replace water lost through the skin.
- 3 Carbon dioxide resulting from respiration is used by a grasshopper to form oxygen.
- 4 Organic acids resulting from photosynthesis are used by a green plant to synthesize glycogen.

29 Which function is *not* associated with cartilage?

- 1 producing blood cells
- 2 cushioning joints against impact
- 3 making up most of an embryonic skeleton
- 4 providing flexibility of structures

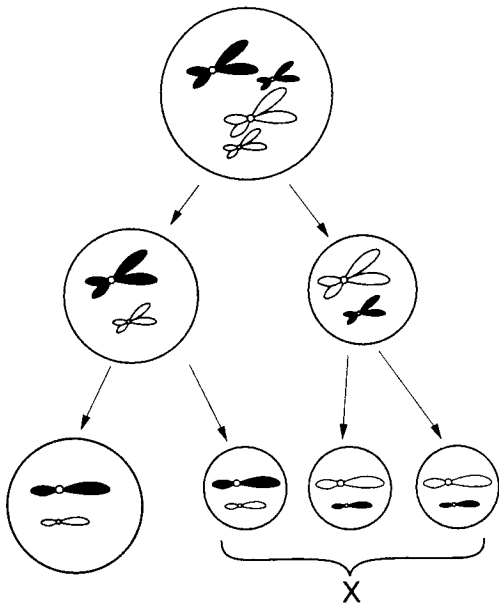
30 Which statement best describes the process of asexual reproduction?

- 1 It involves two parents.
- 2 It occurs without the fusion of nuclei.
- 3 It results in variation in offspring.
- 4 It involves the production of gametes

31 The production of monoploid cells by spermatogenesis occurs in

- | | |
|-------------|-----------|
| 1 ovaries | 3 zygotes |
| 2 meristems | 4 testes |

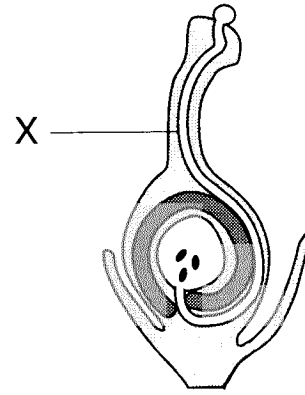
32 The diagram below represents a reproductive process.



The three structures indicated by letter X are known as

- 1 ova
- 2 embryos
- 3 polar bodies
- 4 homologous chromosomes

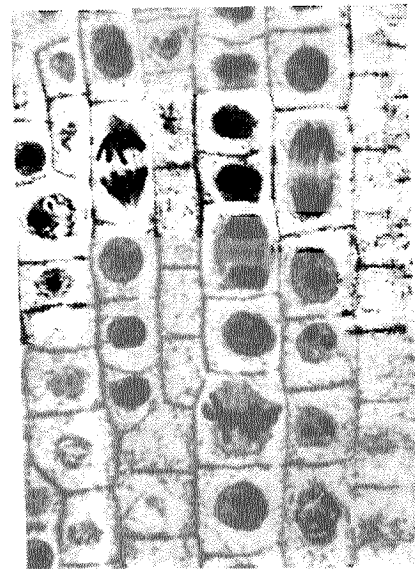
33 The diagram below represents a reproductive process taking place in part of a flower.



The structure labeled X is an adaptation for

- 1 producing pollen
- 2 internal fertilization
- 3 attracting pollinators
- 4 seed dispersal

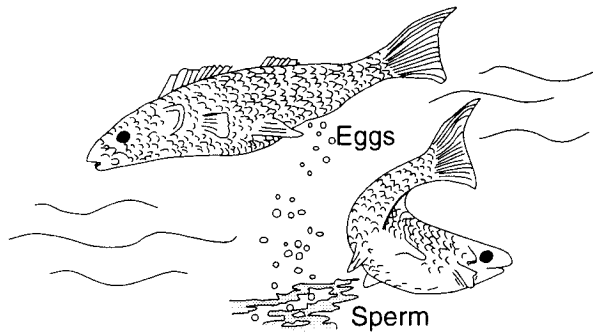
34 A photomicrograph of cells involved in various stages of nuclear division is shown below.



Which title is most appropriate for this photomicrograph?

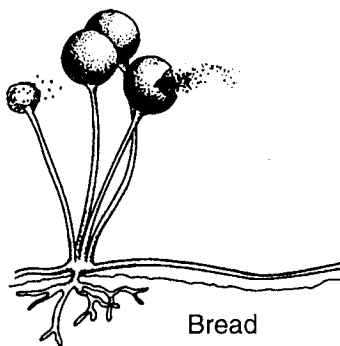
- 1 Mitosis in an Onion Root Tip
- 2 Cell Division in Human Blood Cells
- 3 Meiosis in Male Gametes
- 4 Gametogenesis in Yeast Cells

35 Which type of fertilization and development occurs in the life cycle of the organisms represented below?



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

36 Which method of reproduction is shown in the diagram below?



- | | |
|----------------|-------------------|
| 1 stem cutting | 3 tuber formation |
| 2 budding | 4 sporulation |

37 From which part of the seed will the leaves and the upper portions of the stem of a plant develop?

- | | |
|-------------|-------------|
| 1 hypocotyl | 3 cotyledon |
| 2 epicotyl | 4 seed coat |

38 Gregor Mendel developed some basic principles of heredity by

- 1 crossing pea plants
- 2 cutting off the tails of mice
- 3 breeding fruit flies
- 4 culturing bacteria in a laboratory

39 F represents the gene for brown coat color and f represents the gene for white coat color. In the cross $FF \times ff$, all the offspring have a brown coat. Which genetic principle is illustrated by this cross?

- | | |
|--------------------|---------------|
| 1 crossing-over | 3 codominance |
| 2 multiple alleles | 4 dominance |

40 In a certain type of plant, tall is dominant over short, and green seed coat is dominant over yellow seed coat. When two plants heterozygous for both of these traits are crossed, the offspring produced are tall, with green seed coats; tall, with yellow seed coats; short, with green seed coats; and short, with yellow seed coats. The results of this cross illustrate

- 1 vegetative propagation
- 2 mutagenic agents
- 3 intermediate inheritance
- 4 independent assortment

41 The genes for red hair and freckles are usually inherited together because these genes are

- | | |
|------------------------|-----------------|
| 1 homologous | 3 linked |
| 2 sorted independently | 4 hybrid traits |

42 Which mutation could be passed on to future generations?

- 1 a gene change in a liver cell
- 2 cancer caused by excessive exposure of skin cells to the Sun
- 3 a chromosomal alteration during gametogenesis
- 4 random breakage of a chromatid in a leaf cell of a maple tree

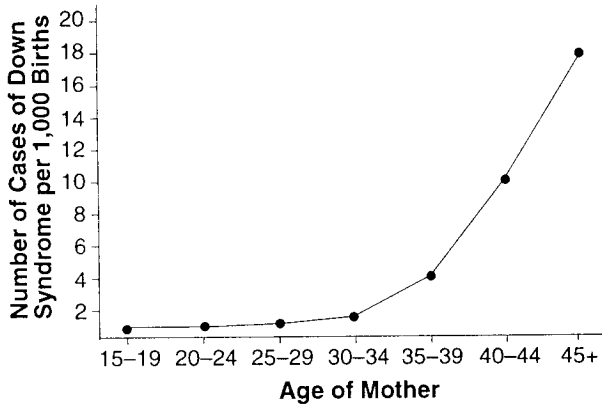
43 Which molecule is correctly paired with its building blocks?

- (1) cellulose — polypeptides
- (2) DNA — nucleotides
- (3) protein — monosaccharides
- (4) fat — disaccharides

44 Which cross could produce a child with blood type A?

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

- 45 Information concerning Down syndrome is represented in the graph below.



A correct inference that can be made from this graph is that with increasing maternal age there is a corresponding increase in the incidence of

- | | |
|------------------|-----------------|
| 1 nondisjunction | 3 recombination |
| 2 polyploidy | 4 hybridization |
- 46 A possible explanation for the differences in structure, function, and behavior between chimpanzees and humans is provided by the
- 1 heterotroph hypothesis
 - 2 lock-and-key model
 - 3 cell theory
 - 4 theory of evolution
- 47 A cat hiding in bushes near a robin's nest observed the mother robin encouraging her offspring to make their first flight. The first young bird flew straight from the nest to a nearby tree. The next three were able to fly to the tree, although they took more time. The last young bird moved its wings too slowly and fell to the ground, where the cat swiftly captured it. This situation illustrates part of the theory of evolution proposed by
- | | |
|-----------|------------|
| 1 Lamarck | 3 Weismann |
| 2 Darwin | 4 Miller |
- 48 Traits that enable an organism to survive and reproduce in its environment are known as
- 1 adaptations
 - 2 differentiations
 - 3 hybrid characteristics
 - 4 acquired characteristics

- 49 Sheep and pigs have more enzymes in common than sheep and frogs do. This finding may indicate that

- 1 none of these animals are related
- 2 frogs are not related to pigs
- 3 sheep are more closely related to pigs than to frogs
- 4 frogs are more closely related to sheep than to pigs

- 50 The bones in the wing of a bird, the flipper of a whale, and the arm of a human are considered by many scientists to be

- 1 heterotrophic aggregates
- 2 abiotic factors
- 3 complex organelles
- 4 homologous structures

- 51 The greatest degree of genetic variation would be found in offspring that result from

- | | |
|------------------|----------------|
| 1 binary fission | 3 regeneration |
| 2 fertilization | 4 grafting |

- 52 According to the heterotroph hypothesis, energy sources for the formation of the first organic molecules from inorganic substances did *not* include

- | | |
|-----------|-------------|
| 1 glucose | 3 lightning |
| 2 heat | 4 radiation |

- 53 The portion of Earth in which all life exists is known as

- | | |
|--------------------|----------------------|
| 1 the climax stage | 3 a population |
| 2 the biosphere | 4 a biotic community |

- 54 The large amount of salt in the air and water of coastal areas determines which species can exist there. In these areas, the salt functions as a

- | | |
|--------------------|-------------------|
| 1 source of energy | 3 food source |
| 2 biotic factor | 4 limiting factor |

- 55 An incomplete food chain is shown below.

algae → minnow → lake trout → X

Which organism could be represented by letter X?

- | | |
|-------------|---------|
| 1 lobster | 3 human |
| 2 jellyfish | 4 robin |

56 Which phrase best describes an ecosystem?

- 1 all the living organisms in a specific location
- 2 all the nonliving materials in a specific location
- 3 some nonliving materials passing through a living organism in a specific location
- 4 living organisms and nonliving materials interacting in a specific location

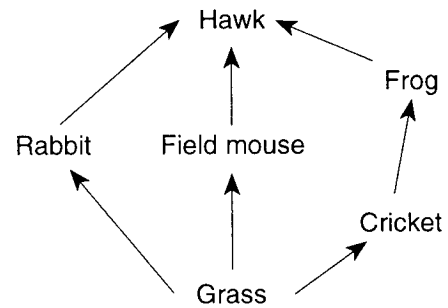
57 Because turkey vultures feed mainly on animals that they have not killed, they are known as

- 1 predators
- 2 scavengers
- 3 omnivores
- 4 autotrophs

58 Many people place bat boxes on their property to provide housing that attracts insect-eating bats. This activity has a positive effect on the environment because it represents an increased use of

- 1 saprophytic relationships
- 2 biocides
- 3 biological controls
- 4 herbicides

59 A food web is shown in the diagram below.



Which statement best describes a direct result of a decrease in the rabbit population due to disease?

- 1 The hawk population will increase.
- 2 The grass population will increase.
- 3 The cricket population will decrease.
- 4 The frog population will be eliminated.

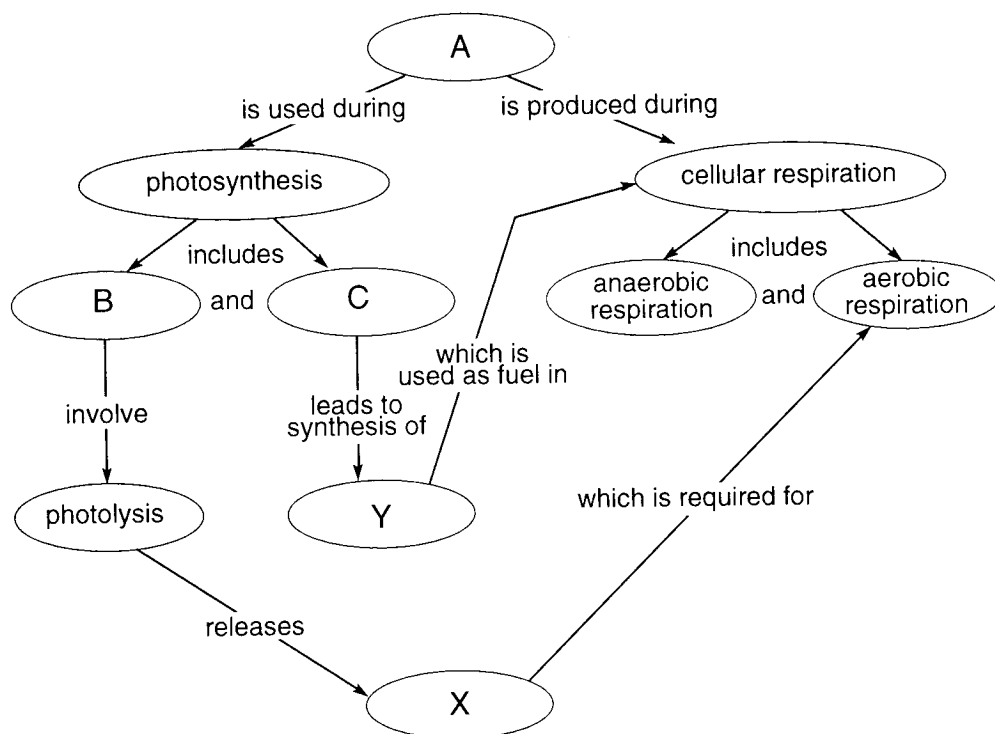
Part II

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 diagram below, which is a concept map that shows the relationship between photosynthesis and respiration, and on your knowledge of biology.



60 Which molecule belongs in area A?

- (1) deoxyribonucleic acid
- (2) adenosine triphosphate
- (3) PGAL
- (4) $C_6H_{12}O_6$

61 In which cell organelle do the reactions that belong in areas B and C occur?

- 1 mitochondrion
- 2 chloroplast
- 3 endoplasmic reticulum
- 4 Golgi complex

62 Which molecule belongs in area X?

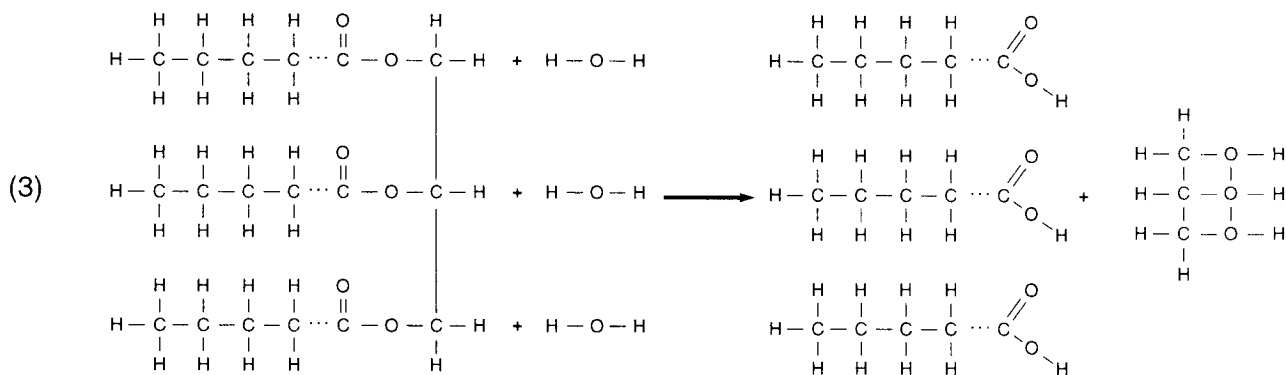
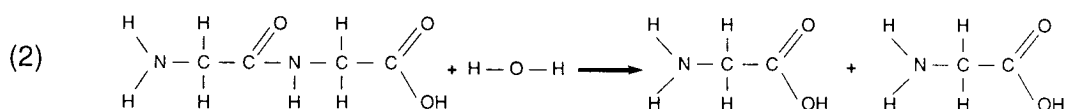
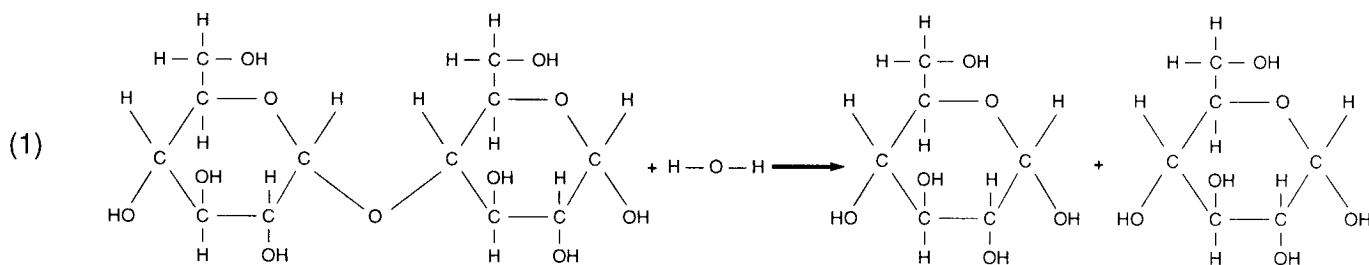
- | | |
|------------------|----------|
| 1 lactic acid | 3 water |
| 2 carbon dioxide | 4 oxygen |

63 Which molecule belongs in area Y?

- | | |
|----------|------------|
| 1 water | 3 glucose |
| 2 oxygen | 4 hydrogen |

Directions (64–65): For each statement in questions 64 and 65, select the equation, chosen from the list of three equations below, that is most closely associated with that statement. Then record its number on the separate answer paper.

Equations



64 This equation represents the digestion of a lipid.

65 This equation represents a process that results in the formation of amino acids.

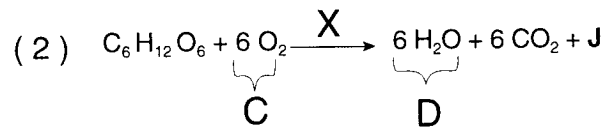
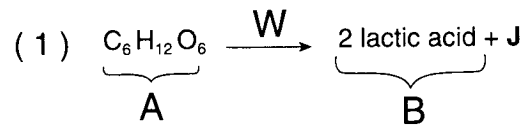
66 Hemoglobin, insulin, albumin, and maltase, which are composed of chains of amino acids, are examples of

- | | |
|-----------------|-----------------|
| 1 proteins | 3 lipids |
| 2 carbohydrates | 4 nucleic acids |

67 The bond that joins two amino acids together is known as

- | | |
|-------------------|------------------|
| 1 a double bond | 3 an ionic bond |
| 2 a hydrogen bond | 4 a peptide bond |

Base your answers to questions 68 and 69 on the chemical reactions below and on your knowledge of biology.



68 The enzymes needed for these chemical reactions are indicated by letters

(1) *W* and *X*

(2) *A* and *C*

(3) *B* and *D*

(4) *B* and *C*

69 What is the chemical compound represented by letter *J*?

(1) a protease

(2) a polysaccharide

(3) ATP

(4) ADP

Group 2 — Human Physiology

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

Directions (70–71): For each phrase in questions 70 and 71, select the disorder affecting the digestive system, chosen from the list below, that is best described by that phrase. Then record its number on the separate answer paper.

Disorders Affecting the Digestive System

- (1) Ulcer
- (2) Constipation
- (3) Diarrhea
- (4) Gallstones

70 Erosion of the surface of a portion of the digestive tract due to the action of irritants

71 Decreased absorption of water in the large intestine

72 Which statement concerning blood pressure is not correct?

- 1 The maintenance of an increased blood pressure can lead to a weakening of heart muscle.
- 2 Blood pressure is partially the result of the contraction of the left ventricle.
- 3 As the intake of saturated fats in the diet increases, the possibility that blood pressure will become elevated also increases.
- 4 Blood pressure is normally higher during diastole than during systole.

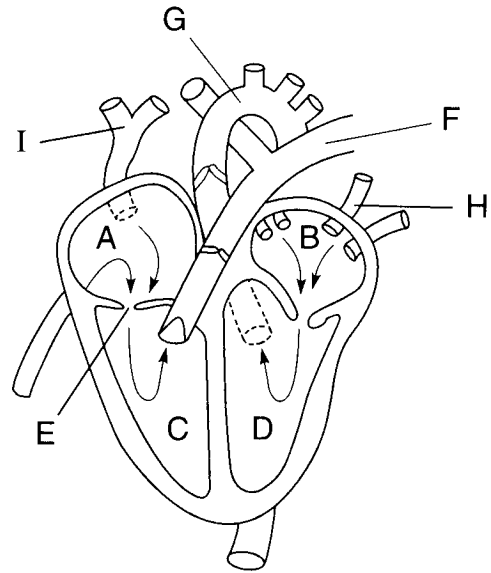
73 Homeostasis is illustrated in the human body by the effects of insulin and glucagon on the amount of

- 1 fats digested into glycerol
- 2 amino acids absorbed by villi
- 3 oxygen transported to the lungs
- 4 glucose in the blood

74 Gland A releases a hormone that causes gland B to release estrogen. Gland A is most likely the

- | | |
|-------------|-----------|
| 1 testis | 3 thyroid |
| 2 pituitary | 4 ovary |

Base your answers to questions 75 and 76 on the diagram of the human heart below and on your knowledge of biology.



75 Which structures normally contain oxygenated blood?

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

76 Which letter indicates a pulmonary artery?

- | | |
|-------|-------|
| (1) F | (3) H |
| (2) G | (4) I |

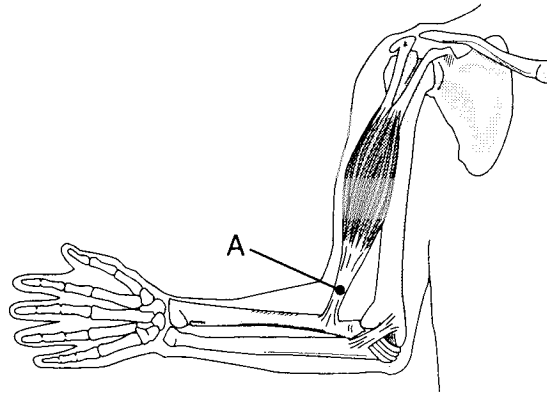
77 Which components of the human diet contain the greatest amounts of sugars and starches?

- | | |
|-------------------------|----------------------|
| 1 meat and eggs | 3 minerals and milk |
| 2 fruits and vegetables | 4 water and vitamins |

78 Regulation of heart rate is most closely associated with the

- 1 cerebrum
- 2 cerebellum
- 3 somatic nervous system
- 4 autonomic nervous system

79 Which disorder would most likely affect the structure indicated by letter A in the diagram below?



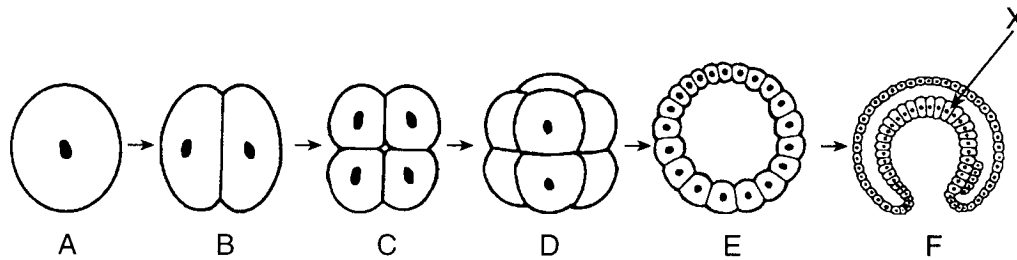
1 bone cancer
2 tendinitis

3 polio
4 meningitis

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 of some stages of embryonic development below and on your knowledge of biology.



80 The blastula is represented by

- | | |
|-------|-------|
| (1) A | (3) F |
| (2) E | (4) D |

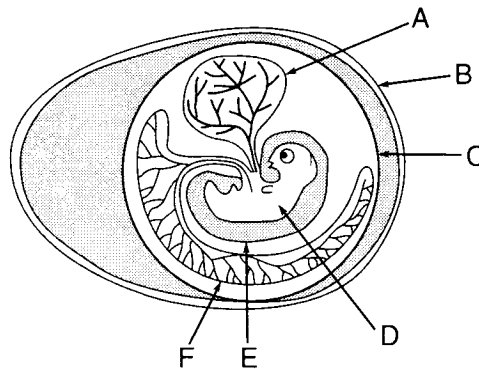
81 These stages could occur in the reproductive cycle of

- | | |
|-------------|---------|
| 1 paramecia | 3 roses |
| 2 fungi | 4 fish |

82 Stages A through D occur immediately after the process of

- | | |
|-----------------|----------------|
| 1 oogenesis | 3 gastrulation |
| 2 fertilization | 4 ovulation |

Base your answers to questions 83 through 85 on the diagram of a developing bird embryo below and on your knowledge of biology.



83 Which structure is specialized for the storage of uric acid?

- | | |
|-------|-------|
| (1) E | (3) C |
| (2) F | (4) D |

84 Which structure contains a watery environment that protects the embryo from shock?

- | | |
|-------|-------|
| (1) A | (3) E |
| (2) B | (4) F |

85 Which structure is present during human development but is *not* shown in the diagram?

- | | |
|------------------|-----------|
| 1 umbilical cord | 3 amnion |
| 2 blood vessel | 4 chorion |

86 In humans, zygote formation normally occurs in the

- | | |
|-----------|-----------|
| 1 ovaries | 3 oviduct |
| 2 testes | 4 cervix |

87 Which two hormones are most closely associated with vascularization of the uterine lining in the human female during the menstrual cycle?

- (1) FSH and testosterone
- (2) progesterone and testosterone
- (3) estrogen and FSH
- (4) estrogen and progesterone

88 The permanent cessation of the menstrual cycle is known as

- | | |
|-------------|-------------|
| 1 menopause | 3 gestation |
| 2 puberty | 4 cleavage |

89 In humans, which structure develops from embryonic mesoderm?

- 1 brain
- 2 lining of the digestive tract
- 3 skeleton
- 4 lining of the respiratory tract

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 most closely associated with that phrase. Then record its *number* on the separate answer paper.

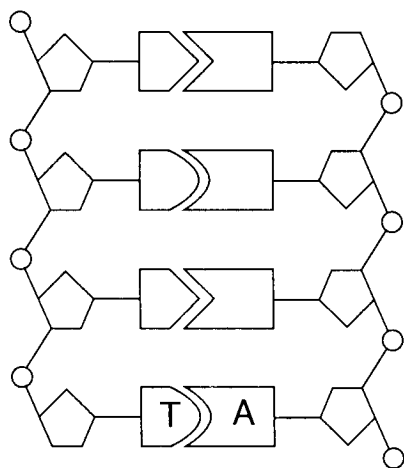
Genetic Disorders

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

90 Deterioration of nerve tissue due to the accumulation of fatty material

91 Presence of abnormal hemoglobin and crescent-shaped red blood cells

92 Which statement best describes a portion of the molecule represented below?



- 1 It consists of many ribose sugars.
- 2 It unites with amino acids in the cytoplasm.
- 3 It contains uracil, which functions in protein synthesis.
- 4 It consists of alternating phosphate groups and deoxyribose molecules.

93 The study of factors that affect gene frequencies in the members of a species of sexually reproducing organisms living in a given area is known as

- 1 Mendelian genetics
- 2 genetic screening
- 3 population genetics
- 4 genetic engineering

94 Four stages in the production of protein molecules in a cell are listed below.

A — Transfer RNA molecules bring amino acids to the ribosome.

B — DNA molecules serve as templates for messenger RNA molecules.

C — Messenger RNA molecules move to ribosomes.

D — Polypeptides are formed on ribosomes.

Which sequence best represents the correct order of these stages?

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

95 If a portion of a messenger RNA molecule contains the base sequence A-A-U, the corresponding transfer RNA base sequence is

- (1) A-A-U
- (2) G-G-T
- (3) T-T-C
- (4) U-U-A

96 A species is likely to remain *unchanged* if

- 1 natural selection affects all members of the species
- 2 some individual members of the species become isolated
- 3 the gene pool of the species remains stable
- 4 all members of the species migrate to a new environment

97 Which statement concerning an organism produced by cloning is correct?

- 1 The clone is genetically identical to its parent.
- 2 The clone has the combined genes of both of its parents.
- 3 The genotype of the clone will be somewhat different from that of its parent.
- 4 The phenotype of the clone will be entirely different from that of its parents.

98 A photograph of human chromosomes that may be studied to determine possible genetic disorders is known as

- | | |
|-----------------|--------------|
| 1 a karyotype | 3 screening |
| 2 amniocentesis | 4 a pedigree |

99 In the portions of the DNA molecules below, *X* represents the base sequence of strand I in the original DNA molecule, and *Y* represents the base sequence of strand I in the newly formed DNA molecule.

X: A-T-G-C-C-A-T-A-G

Y: A-T-G-C-C-A-A-T-G

The base sequence in *Y* is an example of

- 1 polyploidy
- 2 a chromosome deletion
- 3 a gene mutation
- 4 translocation

Group 5 — Ecology

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

Base your answers to questions 100 through 102 on the biomes listed below and on your knowledge of biology.

Biomes

- (A) Tropical rain forest
- (B) Temperate deciduous forest
- (C) Taiga
- (D) Tundra
- (E) Grassland
- (F) Desert

100 Which biome is characterized by considerable variability in rainfall and temperature and the presence of antelope and bison?

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

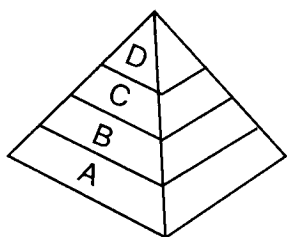
101 Which biome is characterized by moderate rainfall, cold winters, and the presence of fox and deer?

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

102 Which biome is characterized by sparse rainfall and the presence of succulent plants and kangaroo rats?

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

103 The diagram below represents a biomass pyramid.



Which level of the pyramid most likely contains the greatest mass of herbivores?

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

Base your answers to questions 104 and 105 on the paragraph below and on your knowledge of biology.

Leeches often attach to the tongue of a crocodile and consume the crocodile's blood as food. The Egyptian plover is a bird that flies into the mouth of the crocodile and eats the leeches. The crocodiles do not harm the plovers.

Directions (104–105): For each relationship identified in questions 104 and 105, select the ecological term, chosen from the list below, that identifies that relationship. Then record its number on the separate answer paper.

Ecological Terms

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

104 The relationship between the plover and the crocodile

105 The relationship between the crocodile and the leech

106 Which sequence best represents the stages of succession that would most likely occur in New York State?

- 1 bare rock → beech-maple forest → moss → lichens
- 2 grassland → pine forest → beech-maple forest → marsh → lake
- 3 lake → marsh → grassland → shrubs → beech-maple forest
- 4 pine forest → grassland → shrubs → lichens

107 Bacteria of decay are important components of an ecosystem because they

- 1 recycle organic matter
- 2 are involved in photosynthesis
- 3 absorb solar energy
- 4 slow the spread of disease

108 The type of climax vegetation associated with a terrestrial biome is primarily determined by yearly temperature variation and the

- 1 presence of animal predators
- 2 presence of climax fauna
- 3 number of deciduous trees
- 4 annual precipitation

109 A bird lives in a tree in a forest, where it builds a nest and lays two eggs. The chicks hatch, and the mother feeds the chicks insects she has plucked from the tree bark. This information helps most in determining the bird's

- 1 niche
 - 2 rate of metabolism
 - 3 biomass
 - 4 migratory pattern
-

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 below and on your knowledge of biology.

An investigation was performed to determine the effect of temperature on the respiratory rate of a goldfish. The respiratory rate was measured by the number of gill cover movements per minute. The following data were collected.

Data

60 gill cover movements at 23°C	57 gill cover movements at 25°C
15 gill cover movements at 10°C	25 gill cover movements at 15°C
30 gill cover movements at 18°C	25 gill cover movements at 27°C

110 Complete both columns of the data table *on your answer paper* so that the temperatures are *increasing from the top to the bottom of the data table*. The data table below is provided for practice purposes only. Be sure your final answer appears *on your answer paper*. You may use pen or pencil for your answer.

Data Table

Temperature (°C)	Gill Cover Movements Per Minute

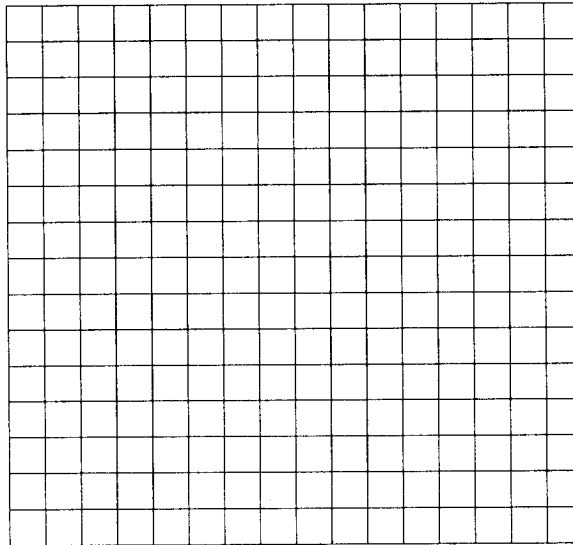
Directions (111–112): Using the information in the data table, construct a line graph on the grid *provided on your answer paper*, following the directions below. The grid on the next page is provided for practice purposes only. Be sure your final answer appears *on your answer paper*. You may use pen or pencil for your answer.

111 Mark an appropriate scale on each labeled axis.

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



Gill Cover Movements Per Minute



Temperature (°C)

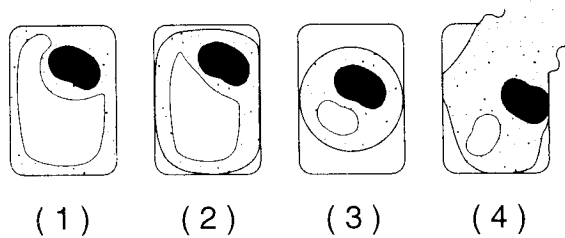
113 Which inference is best supported by the data?

- 1 The higher the temperature, the higher the rate of gill cover movements of goldfish.
 - 2 At both 10°C and 27°C, goldfish use less energy than at 23°C.
 - 3 Goldfish are not affected as water temperature increases from 10°C to 27°C.
 - 4 Goldfish reproduce more successfully in water at 15°C than at 27°C.
-

114 A student using a compound light microscope to study plant cells observed that most of the cells resembled the diagram shown below.



Which diagram best illustrates how these plant cells will appear after they are placed in a solution having a lower water concentration than the cells have?



Group 2

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

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

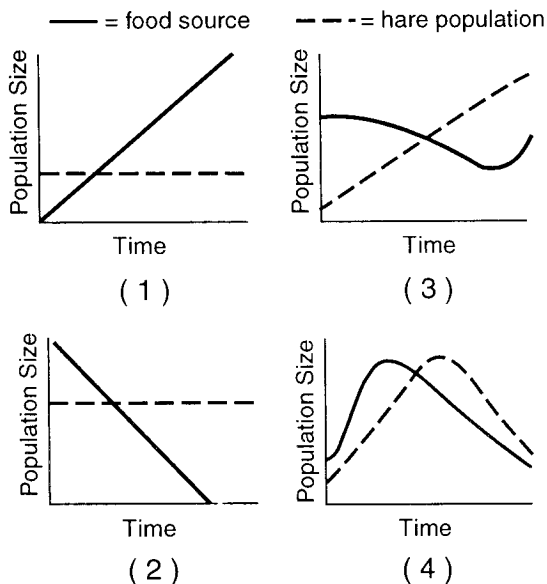
Avoid Being Eaten

The snowshoe hare (*Lepus americanus*) is the prey of many woodland animals. Foxes, coyotes, martens, and weasels hunt the hares by day, while the great horned and barred owls hunt them on silent wings at night. The snowshoe hare survives this predation partly as a result of the effects of changing environmental conditions on the expression of genes for fur color, resulting in effective camouflage. In winter months, the hare has white fur, which blends into the snowscape. During the warmer months, the fur changes to a reddish brown.

Some favorite foods of the hare during the winter months are twigs of the maple, birch, and apple trees. Grasses and clover replace this diet during the spring and summer. Hares tend to feed during the hours of dusk and dawn, when the light is low and the predators are inactive.

The hares prefer habitats along streams, wetlands, and spruce forests. Their breeding season in New York State begins in March, and a female can have a litter of one to six young only 5 weeks after mating. The young hares are able to see, are fully furred, and are able to walk and hop soon after birth. Females nurse their young until they are about a month old. Within one season, a female may have up to four litters. The snowshoe hare population tends to vary throughout the year because individual animals have a short lifespan. There seem to be cycles of about 10 years, during which the population varies from about 0.1 hare per acre up to 5 hares per acre. Some biologists suggest that the cycles are related to predation and the depletion of the hare's food sources.

115 If food supply is the only limiting factor, which graph best represents a possible relationship between the population of snowshoe hares and their food supply over a 10-year period?



116 What is the genus of this hare?

- 1 animal
- 2 *Lepus*
- 3 *americanus*
- 4 snowshoe

117 Based on its diet, the hare is classified as

- 1 an herbivore
- 2 a carnivore
- 3 an autotroph
- 4 a decomposer

118 Using one or more complete sentences, state one adaptive advantage to the hare of being able to see, being fully furred, and being able to walk and hop soon after birth.

119 The results of one experiment carried out by a research team would be considered valid if

- 1 the experiment had no control setup
 - 2 all the members of the research team came to the same conclusion
 - 3 the experiment had more than one variable
 - 4 the experiment was repeated and the same results were obtained each time
-

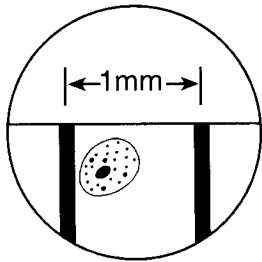
Group 3

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

120 Which paragraph describes the correct procedure for preparing a stained wet mount of onion epidermis?

- (1) Place a slice of onion epidermis on a slide. Add two drops of water and one drop of stain. Cover the slice by dropping a coverslip directly on top of it. Press on the coverslip to force air bubbles out. Add one drop of water to one edge of the coverslip, and add one drop of stain to the opposite edge.
- (2) Add one drop of stain to a piece of onion epidermis. Using forceps, place the epidermis on a slide. Blot the epidermis with a piece of paper towel to remove the excess stain. Drop a coverslip onto the specimen.
- (3) Place a piece of onion epidermis on a slide. Add one drop of water. Put one edge of a coverslip in the water drop, then slowly lower the opposite edge to the water. Put one drop of stain at one edge of the coverslip. Put a piece of paper towel at the opposite side of the coverslip. Allow the towel to absorb some water so that the stain will move under the coverslip.
- (4) Add one drop of stain to a slide. Place a piece of onion epidermis on top of the stain. Use a piece of paper towel to absorb the stain. Drop a coverslip on the epidermis to flatten it out. Lift the coverslip and add a drop of water to the epidermis. Replace the coverslip.

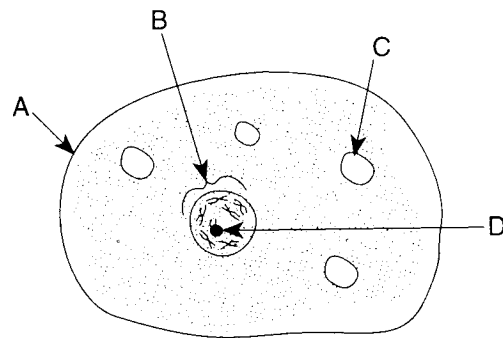
121 What is the approximate diameter of the cell shown in the low-power field of a compound light microscope represented below?



- (1) 100 μm (3) 800 μm
(2) 500 μm (4) 1,000 μm

122 A student observed a paramecium under the low-power objective (10 \times) of a compound light microscope. The student then switched to the high-power objective (50 \times). State one change that would be evident in the field of view when the student switched to the high-power objective. You may use pen or pencil for your answer.

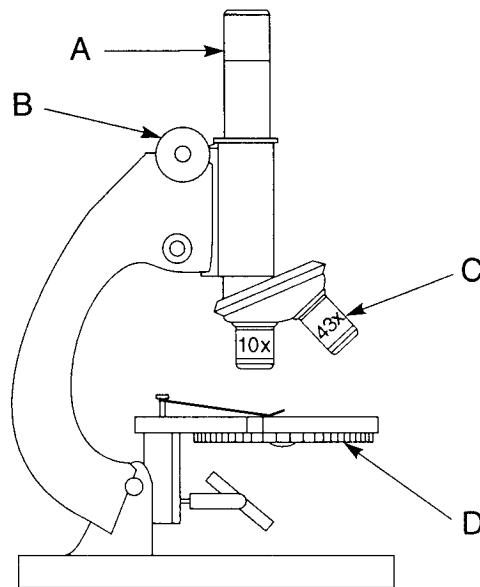
123 A cell is represented in the diagram shown below.



Which statement about the cell is correct?

- 1 Structure A synthesizes and secretes cellular products.
- 2 Structure B contains nucleotides involved in transmitting genetic information.
- 3 Structure C utilizes carbon dioxide in the process of photosynthesis.
- 4 Structure D is the site of aerobic respiration.

124 A compound light microscope is represented in the diagram below.



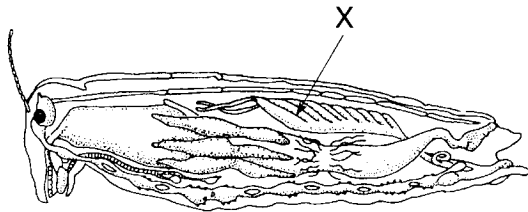
Which microscope part is correctly paired with its function?

- (1) *A* — magnifies the image of the specimen
 - (2) *B* — used for focusing only when the high-power objective is used
 - (3) *C* — provides the field of view with the largest diameter
 - (4) *D* — holds the specimen on the stage
-

Group 4

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

125 A diagram of a grasshopper dissection is shown below.



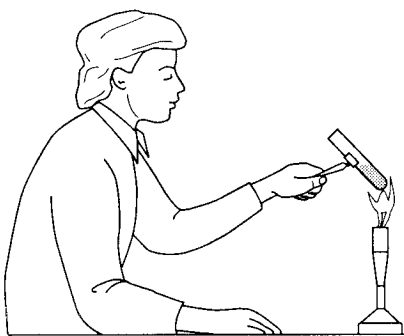
Which statement best describes the location of structure X?

- 1 It is ventral to the nerve cord.
- 2 It is dorsal to the digestive tract.
- 3 It is anterior to the crop.
- 4 It is posterior to the anus.

126 Which laboratory procedure would be best for demonstrating the effect of light intensity on the production of chlorophyll in pea plants?

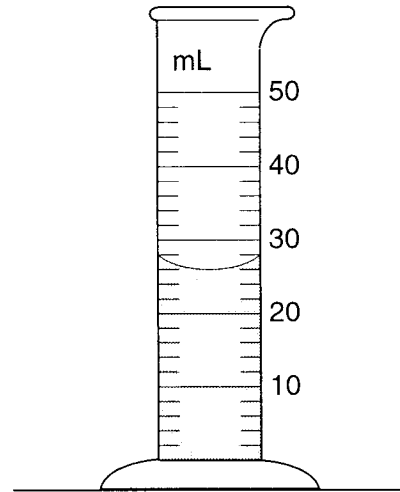
- 1 using 10 plants of different species, each grown under the same intensity of light
- 2 using 10 plants of different species, each grown under a different intensity of light
- 3 using 10 plants of the same species, each grown under the same intensity of light
- 4 using 10 plants of the same species, each grown under a different intensity of light

127 The diagram below shows a student performing a laboratory activity.



Using one or more complete sentences, describe *one* error in the laboratory procedure shown in the diagram. You may use pen or pencil for your answer.

128 What is the volume of the liquid indicated in the diagram below of a graduated cylinder?



- (1) 23 mL
- (2) 26 mL
- (3) 27 mL
- (4) 28 mL

129 One ounce each of protein, carbohydrate, and fat are burned separately in a calorimeter to determine caloric content. The results are shown in the data table below.

Data Table

Organic Compound	Number of Calories Produced
Protein	147
Fat	271
Carbohydrate	152

Which statement represents a valid conclusion based on the data?

- 1 An ounce of fat contains almost twice as many calories as an ounce of protein.
- 2 A protein is a better energy food than a carbohydrate.
- 3 Carbohydrates, fats, and proteins all yield approximately the same number of calories per unit of weight.
- 4 Proteins and carbohydrates provide the most calories per ounce.

Group 5

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

- 130 To observe the aortic arches of an earthworm, a student should use
- 1 an ultracentrifuge
 - 2 a dissecting microscope
 - 3 an electron microscope
 - 4 a pipette
- 131 Which substance should be used to determine if a solution is basic?
- (1) methylene blue
 - (2) Benedict's solution
 - (3) Lugol's iodine
 - (4) pH paper
- 132 A student is investigating the effect of different environmental factors on the growth of a certain species of bean plant over a period of 30 days. Which factor would *not* function as a variable in this investigation?
- 1 species of bean plant
 - 2 soil moisture content
 - 3 amount of light
 - 4 atmospheric temperature
- 133 The directions for a laboratory activity call for 50 milliliters (mL) of solution A. A student accidentally takes 55 mL from the stock bottle. What should the student do with the extra 5 mL of solution A?
- 1 Return the extra 5 mL to the stock bottle and replace the cap.
 - 2 Pour the extra 5 mL down the drain and rinse the sink with cold water.
 - 3 Dilute the extra 5 mL with 100 mL of water and pour it down the drain.
 - 4 Set the extra 5 mL aside in a labeled beaker and ask the teacher for advice.
- 134 Chromocenters are regions of the nucleus that appear very dark when certain dyes are applied to cells. Recently, scientists found that organisms that have the ability to regenerate lost body parts, such as flatworms and earthworms, contain cells with many chromocenters. Using one or more complete sentences, state an inference that can be made about the number of chromocenters present in human cells. You may use pen or pencil for your answer.
-



BIOLOGY

Thursday, August 12, 1999 — 12:30 to 3:30 p.m., only

Part I Score
(Use table below)	
Part II Score
Part III Score
Total Score

Rater's Initials:

ANSWER PAPER

Student Sex: Male Female

Teacher School

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

Part I (65 credits)

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

PART I CREDITS

Directions to Teacher:

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

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

No. right

Part II (20 credits)

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

Group 1
Biochemistry

- 60 1 2 3 4
- 61 1 2 3 4
- 62 1 2 3 4
- 63 1 2 3 4
- 64 1 2 3
- 65 1 2 3
- 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 5
- 105 1 2 3 4 5
- 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

Group 4

125 1 2 3 4

126 1 2 3 4

127 _____

128 1 2 3 4

129 1 2 3 4

Group 5

130 1 2 3 4

131 1 2 3 4

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