

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

BIOLOGY

Wednesday, January 28, 1998 — 9:15 a.m. to 12:15 p.m., only

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

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

SAMPLE: ① 2 3 4

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

SAMPLE: ⊗ 2 3 4

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

When you have completed the examination, you must sign the statement printed at the end of the answer paper, indicating that you had no unlawful knowledge of the questions or answers prior to the examination and that you have neither given nor received assistance in answering any of the questions during the examination. Your answer paper cannot be accepted if you fail to sign this declaration.

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

Part I

Answer all 59 questions in this part. [65]

Directions (1-59): For each statement or question, select the word or expression that, of those given, best completes the statement or answers the question. Record your answer on the separate answer paper in accordance with the directions on the front page of this booklet.

1 An organism takes materials from its environment and processes them for its use. This statement best describes the life function known as

- 1 transport
- 2 excretion
- 3 nutrition
- 4 regulation

2 Which organisms are represented in the cartoon below?



- 1 coelenterates
- 2 annelids
- 3 arthropods
- 4 chordates

3 Living things contain units of structure and function that arise from preexisting units. This statement best describes the

- 1 cell theory
- 2 lock-and-key model of enzyme activity
- 3 concept of natural selection
- 4 heterotroph hypothesis

4 Which structures could most likely be observed in cells in the low-power field of a compound light microscope?

- 1 cell walls and chloroplasts
- 2 ribosomes and endoplasmic reticula
- 3 lysosomes and genes
- 4 nucleotides and mitochondria

5 What would most likely happen if the ribosomes in a cell were not functioning?

- 1 The cell would undergo uncontrolled mitotic cell division.
- 2 The synthesis of enzymes would stop.
- 3 The cell would produce antibodies.
- 4 The rate of transport of glucose in the cytoplasm would increase.

6 Most of the chemical reactions occurring in a living cell depend on the presence of an inorganic compound known as

- 1 glycerol
- 2 glycogen
- 3 maltose
- 4 water

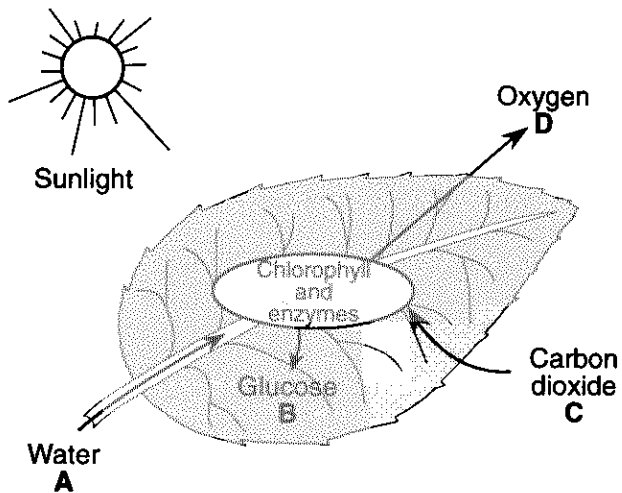
7 What is a major distinction between living and nonliving matter?

- 1 Living matter is unable to diffuse materials.
- 2 Living matter is able to control chemical activities with organic catalysts.
- 3 Living matter is able to create energy.
- 4 Living matter is unable to use energy for metabolic activities.

8 Which organism is correctly paired with its main adaptation for gas exchange?

- 1 amoeba — nucleus
- 2 earthworm — nephridia
- 3 grasshopper — tracheal tubes
- 4 human — skin

Base your answers to questions 9 and 10 on the diagram below and on your knowledge of biology. The diagram represents some processes occurring in the leaf of a plant.



9 Which equation illustrates a process of nutrition carried out within the leaf?

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

10 Which letters indicate substances needed by the leaf to carry out the process of aerobic cellular respiration?

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

11 Which activity is illustrated in the diagram below?

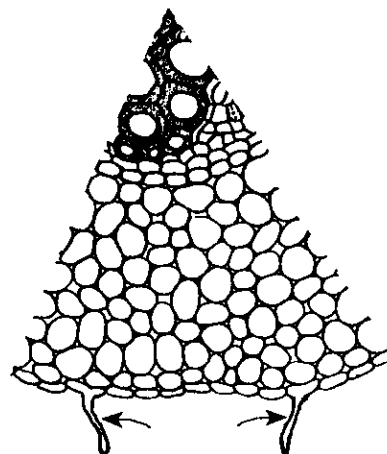


- 1 a virus destroying a cell by extracellular digestion
- 2 a member of the bryophyte phylum performing intercellular digestion
- 3 a protozoan ingesting food during heterotrophic nutrition
- 4 a lysosome egesting a food particle into the cytoplasm

12 Transport can be described as a process that

- 1 involves absorption of material into cells, followed by cyclosis
- 2 results in the formation of small, soluble molecules
- 3 requires the formation of spindle fibers to move chromosomes
- 4 uses radiant energy to maintain concentration differences

13 The diagram below represents a portion of a cross section of a root.



Materials enter the root at the location of the arrows by

- 1 diffusion, only
- 2 phagocytosis, only
- 3 diffusion and active transport
- 4 phagocytosis and pinocytosis

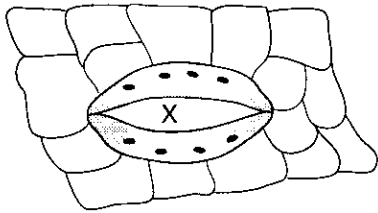
14 Which organism has a transport system most similar to that of the earthworm?

- 1 geranium
- 2 human
- 3 hydra
- 4 ameba

15 All producers and consumers use the chemical process of respiration to synthesize

- (1) $C_6H_{12}O_6$
- (2) ATP
- (3) alcohol
- (4) oxygen

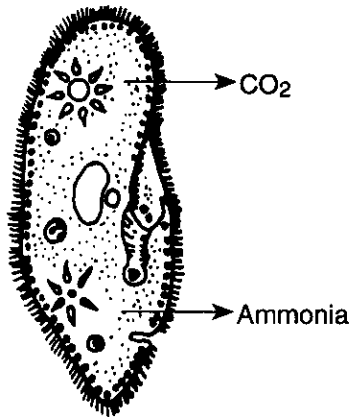
- 16 The diagram below shows a microscopic view of the lower epidermis of a maple leaf.



The area indicated by letter X is known as

- | | |
|--------------|-----------------|
| 1 a stoma | 3 xylem tissue |
| 2 a lenticel | 4 phloem tissue |

- 17 Which activity is represented by the arrows in the diagram below?



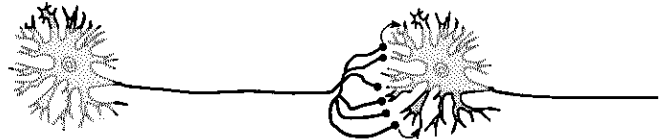
- | |
|---------------------------------|
| 1 anaerobic respiration |
| 2 autotrophic nutrition |
| 3 deamination of amino acids |
| 4 excretion of metabolic wastes |

- 18 Brine shrimp live in shallow coastal waters or near the surface of the ocean where light penetrates. Under laboratory conditions, brine shrimp are attracted to areas with the greatest light intensity and avoid areas of low light intensity. The movement of the brine shrimp to bright light is an example of
- | | |
|---------------------|--------------------|
| 1 negative feedback | 3 a stimulus |
| 2 a response | 4 active transport |

- 19 Hydra remove nitrogenous wastes from their cells mainly by

- | |
|---|
| 1 diffusion into their bloodstream |
| 2 diffusion into their watery environment |
| 3 active transport into their excretory tubules |
| 4 active transport into their respiratory tubes |

- 20 The diagram below represents part of the human nervous system.



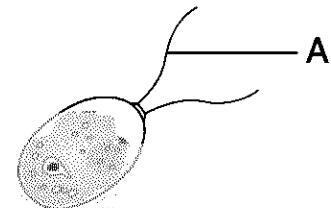
The arrows in the diagram show the

- | |
|---|
| 1 movement of a stimulus in a cyton |
| 2 transport of oxygen in a nerve |
| 3 transfer of an impulse from one neuron to another |
| 4 response of an effector to a stimulus |

- 21 Which statement illustrates a plant tropism?

- | |
|--|
| 1 A stem bends toward the light. |
| 2 An apple develops from a flower. |
| 3 Water moves through vascular tissue. |
| 4 Carbon dioxide diffuses out of a stem. |

- 22 The diagram below represents a green alga.



Which process is most closely associated with structure A?

- | | |
|-------------|----------------|
| 1 excretion | 3 locomotion |
| 2 transport | 4 reproduction |

23 Some characteristics of digestive systems are listed below.

- A Food is moved along by peristalsis.
- B Food is moved along by involuntary muscles.
- C Accessory organs are present.

Which characteristics best describe the human digestive system?

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

24 Which statement most accurately describes the human heart?

- 1 It has two atria and one ventricle, and it pumps blood directly into veins.
- 2 It has one atrium and one ventricle, and it is composed of cardiac muscle.
- 3 It has one atrium and two ventricles, and it is composed of visceral muscle.
- 4 It has two atria and two ventricles, and it pumps blood directly into arteries.

25 When humans exhale, air passes from the trachea directly into the

- 1 bronchioles
- 2 alveoli
- 3 bronchi
- 4 pharynx

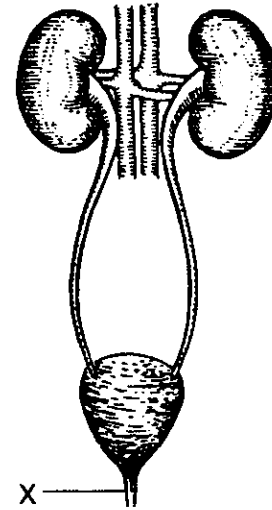
26 Which human excretory structure aids in the maintenance of normal body temperature?

- 1 sweat gland
- 2 nephron
- 3 liver
- 4 urinary bladder

27 Which statement does *not* correctly describe a function of cartilage?

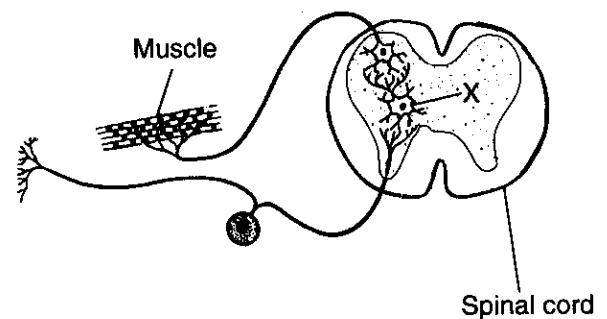
- 1 It anchors muscles to bones.
- 2 It provides flexibility in an embryo.
- 3 It makes up the outer ear.
- 4 It cushions bones at a joint.

28 What is the principal function of structure X represented in the diagram below?



- 1 filtration of cellular wastes from the blood
- 2 transport of urine out of the body
- 3 storage of urine
- 4 secretion of hormones

29 A reflex arc is illustrated in the diagram below.



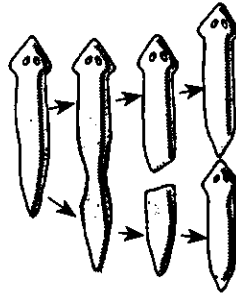
Structure X represents

- 1 an effector
- 2 a motor neuron
- 3 an interneuron
- 4 a receptor

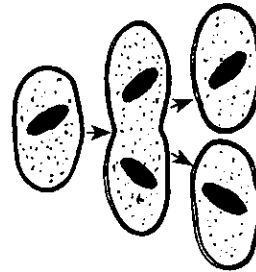
30 Which diagram represents the type of asexual reproduction known as regeneration?



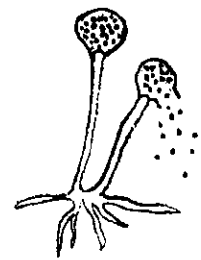
(1)



(2)



(3)



(4)

31 Which statement most accurately compares mitotic cell division in plant and animal cells?

- 1 It is exactly the same in plant and animal cells.
- 2 The walls of plant cells pinch in, but the membranes of animal cells do not.
- 3 Most plant cells use centrioles, but most animal cells do not.
- 4 In both plants and animals, the daughter cells are genetically identical to the original cell.

32 In which process is the pairing of homologous chromosomes followed by the disjunction of these chromosome pairs?

- 1 binary fission
- 2 budding
- 3 meiosis
- 4 fertilization

33 Which statement best describes internal fertilization?

- 1 It does not require motile gametes.
- 2 It helps to make terrestrial life possible.
- 3 It requires the presence of many eggs.
- 4 It normally occurs in the male.

34 What are the normal chromosome numbers of a sperm, egg, and zygote, respectively?

- 1 monoploid, monoploid, and monoploid
- 2 monoploid, diploid, and diploid
- 3 diploid, diploid, and diploid
- 4 monoploid, monoploid, and diploid

35 When compared with the number of gametes produced from a single human primary sex cell during oogenesis, the number of gametes produced from a single human primary sex cell during spermatogenesis is usually

- 1 four times as great
- 2 twice as great
- 3 half as great
- 4 the same

36 Which diagrams illustrate structures that are *not* directly involved in the survival of a zygote?



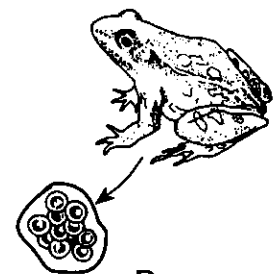
A



C



B

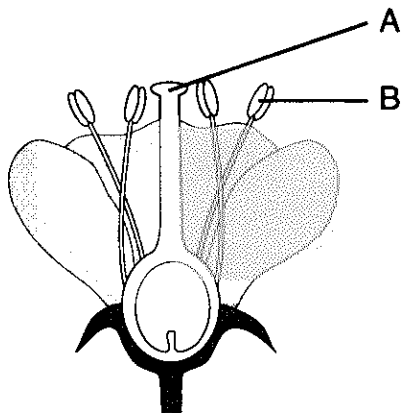


D

- (1) A and D
- (2) B and D

- (3) B and C
- (4) A and C

37 The diagram below represents a flower.



The transfer of reproductive structures from B to A is known as

- | | |
|-------------------|---------------------|
| 1 fertilization | 3 self-pollination |
| 2 differentiation | 4 cross-pollination |

38 Which statement describes the work of Gregor Mendel?

- 1 He developed some basic principles of heredity without having knowledge of chromosomes.
- 2 He explained the principle of dominance on the basis of the gene-chromosome theory.
- 3 He developed the microscope for the study of genes in pea plants.
- 4 He used his knowledge of gene mutations to help explain the appearance of new traits in organisms.

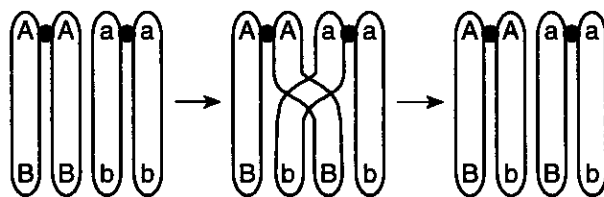
39 In guinea pigs, black fur (B) is dominant over white fur (b) and rough fur (R) is dominant over smooth fur (r). A cross between two guinea pigs hybrid for both traits ($BbRr \times BbRr$) produces some offspring that have rough, black fur and some that have smooth, black fur. The genotypes of these offspring illustrate the genetic concept of

- 1 intermediate inheritance
- 2 independent assortment
- 3 multiple alleles
- 4 codominance

40 The gene for tallness (T) is dominant over the gene for shortness (t) in pea plants. A homozygous dominant pea plant is crossed with a heterozygous pea plant, and 200 seeds are produced. Approximately how many of these seeds can be expected to produce plants that are homozygous dominant?

- | | |
|--------|---------|
| (1) 0 | (3) 100 |
| (2) 50 | (4) 200 |

41 Which statement best describes the process illustrated in the diagram below?



- 1 Nondisjunction occurs during segregation, resulting in a chromosomal mutation.
- 2 Crossing-over occurs during synapsis, leading to increased variation.
- 3 Exposure to mutagenic agents causes gene linkage in nonhomologous chromosomes.
- 4 Inbreeding causes random breakage and recombination of chromosome parts.

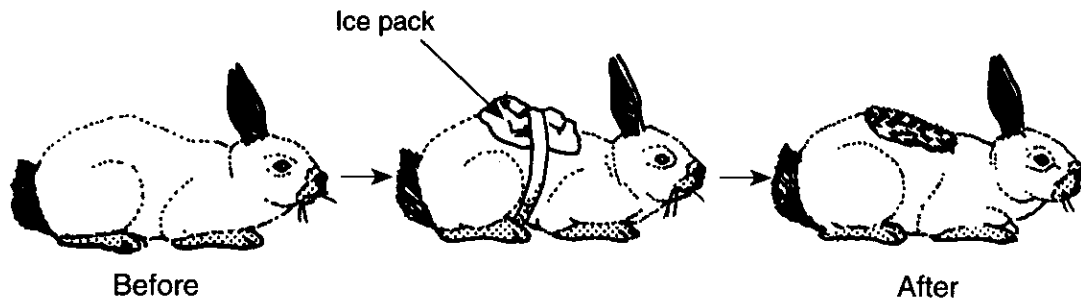
42 Genes carried only on an X-chromosome are said to be

- | | |
|--------------|--------------|
| 1 hybrid | 3 autosomal |
| 2 codominant | 4 sex-linked |

43 In which situation could a mutation be passed on to the offspring of an organism?

- 1 Ultraviolet radiation causes skin cells to undergo uncontrolled mitotic division.
- 2 The DNA of a human lung cell undergoes random breakage.
- 3 A primary sex cell in a human forms a gamete that contains 24 chromosomes.
- 4 A cell in the uterine wall of a human female undergoes a chromosomal alteration.

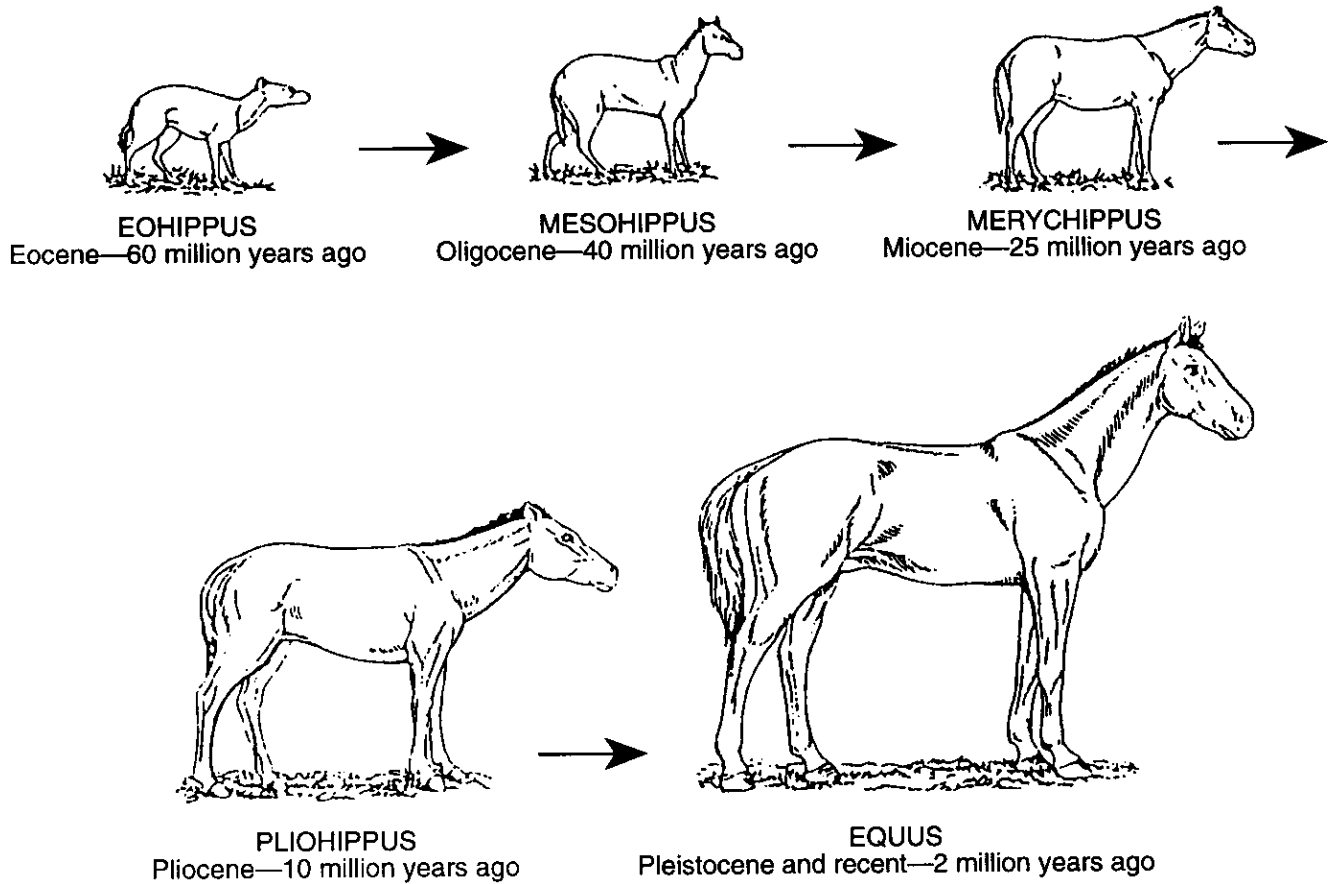
- 44 The diagram below illustrates what happens to the fur coloration of a Himalayan hare after exposure to a low temperature.



This change in fur coloration is most likely due to

- 1 the effect of heredity on gene expression
 - 2 the arrangement of genes on homologous chromosomes
 - 3 environmental influences on gene action
 - 4 mutations resulting from a change in the environment
-
- 45 DNA is a polymer consisting of repeating units known as
- | | |
|---------------|-----------------|
| 1 dipeptides | 3 amino acids |
| 2 nucleotides | 4 organic salts |
- 46 The diagram below represents undisturbed rock strata in a given region. A representative fossil of an organism is illustrated in each layer.
-
- The diagram shows three layers of rock strata. The top layer contains a fossil of organism C, the middle layer contains a fossil of organism B, and the bottom layer contains a fossil of organism A. The strata are tilted to the right.
- 47 In the early stages of development, the embryos of birds and reptiles resemble each other in many ways. This resemblance suggests that they
- 1 belong to the same species
 - 2 are adapted for life in the same habitat
 - 3 share a common ancestry
 - 4 are both animal-like protists
- 48 In addition to the basic ideas of Darwin, the modern theory of evolution includes the concept that
- 1 variations are the result of mutations and gene recombination
 - 2 overproduction of organisms leads to extinction
 - 3 variations exist only in large populations
 - 4 competition occurs only between members of the same species
- 49 What will most likely happen if the gene frequencies in a given population remain constant?
- 1 Recessive characteristics will increase in the population.
 - 2 Evolution will not take place within that population.
 - 3 Dominant characteristics will increase in the population.
 - 4 Evolution within that population will occur at a faster rate.
- Which statement best describes a relationship between these representative organisms?
- 1 Organism A was probably more structurally advanced than organism B and organism C.
 - 2 Organism C probably gave rise to organism A and organism B.
 - 3 All of these organisms probably evolved at the same time.
 - 4 Organism A was probably more primitive than organism B and organism C.

50 The diagrams below represent some structural changes that occurred over time, resulting in the development of the modern horse.



This sequence of structural changes best illustrates the concept of

- | | |
|-------------------------|----------------------------|
| 1 organic evolution | 3 intermediate inheritance |
| 2 ecological succession | 4 geographic isolation |

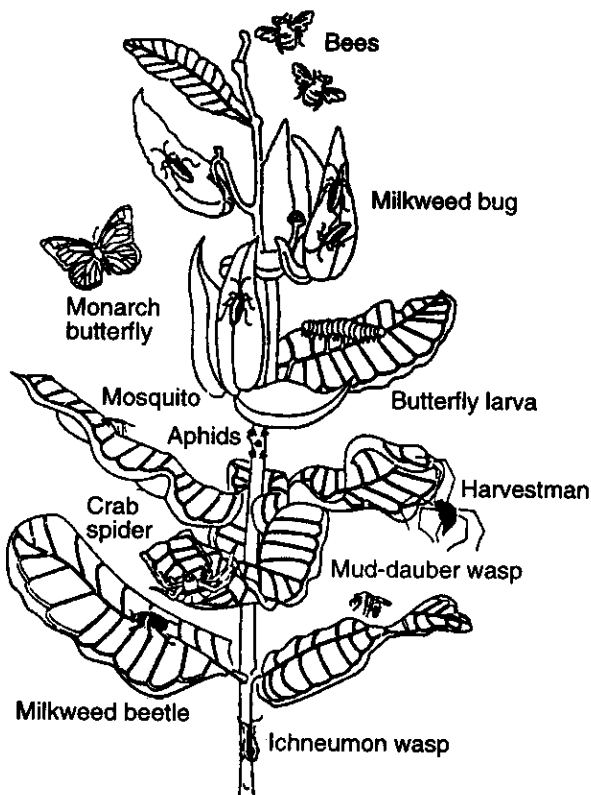
51 Some species undergo long periods of stability interrupted by geologically brief periods of significant change. During these brief periods, new species may evolve. This pattern of evolution is part of the concept of

- 1 use and disuse
- 2 reproductive isolation
- 3 homologous structures
- 4 punctuated equilibrium

52 One widely accepted theory states that the first forms of life were heterotrophs. Later, some organisms developed the ability to use atmospheric carbon dioxide to produce organic nutrients. Organisms with this capability represented the evolution of the first

- | | |
|--------------|---------------|
| 1 herbivores | 3 decomposers |
| 2 carnivores | 4 autotrophs |

53 The diagram below shows a milkweed plant and some of the insects that live on it or visit it.



Which term best describes the group of organisms in the diagram?

- | | |
|-------------|-----------|
| 1 biosphere | 3 habitat |
| 2 community | 4 biome |

54 Hawks and owls living in the same area compete for the same type of mouse for food. Which situation would lead to the greatest problem in food supply?

- 1 an increase in the owl population
- 2 an increase in the mouse population
- 3 a decrease in the hawk population
- 4 a decrease in the owl population

55 Which group represents a population?

- 1 all the vertebrates living in New York State
- 2 all the *Homo sapiens* living in New York State
- 3 all the plant and animal species found in New York State
- 4 all the flowering plants found in New York State

56 A student measured some abiotic factors present in an aquarium in a biology laboratory. Which data did the student most likely record?

- 1 the weight and color of each type of scavenger
- 2 the number of each type of green plant and each type of snail
- 3 the size and number of each species of fish
- 4 the temperature and oxygen content of the water

57 Energy stored in organic molecules is passed from producers to consumers. This statement best describes an event in

- 1 the process of photosynthesis
- 2 natural selection
- 3 a food chain
- 4 ecological succession

58 Which material cycle relies *least* on the processes of photosynthesis, transpiration, evaporation, respiration, and condensation?

- | | |
|------------------|----------------|
| 1 oxygen cycle | 3 water cycle |
| 2 nitrogen cycle | 4 carbon cycle |

59 The use of ladybugs and praying mantises to consume insect pests in gardens is an example of

- 1 biological control of insect pests
- 2 exploitation of insect pests
- 3 abiotic control of insect pests
- 4 use of biocides to control insect pests

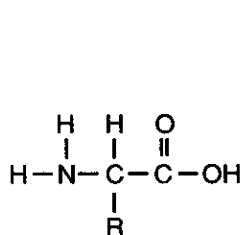
Part II

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

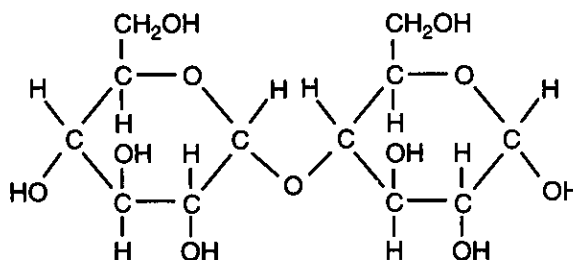
Group 1 — Biochemistry

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

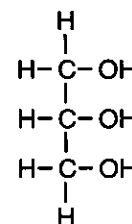
Base your answers to questions 60 through 62 on the organic compounds represented below and on your knowledge of biology.



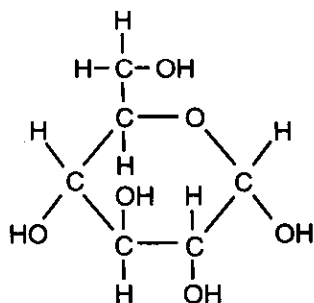
A



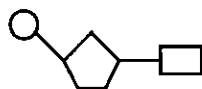
B



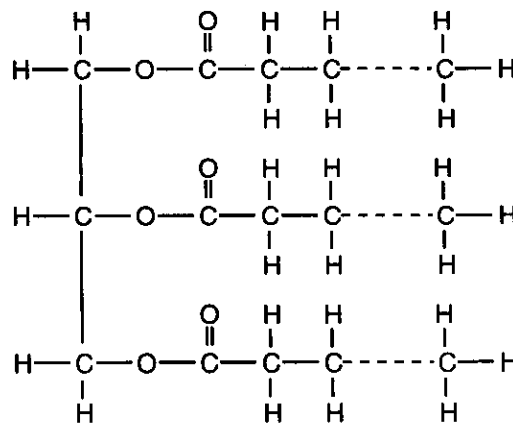
C



D



E



F

60 Which compound contains both an amino group and a carboxyl group?

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

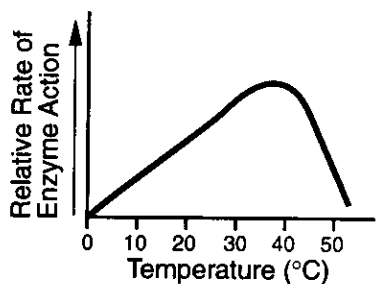
61 Which compounds represent carbohydrates?

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

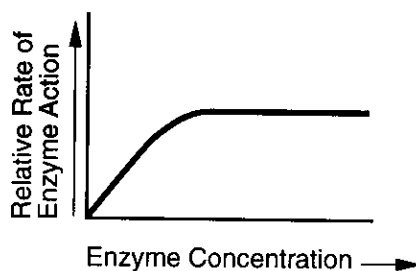
62 Which compound represents the basic unit of both a DNA molecule and an RNA molecule?

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

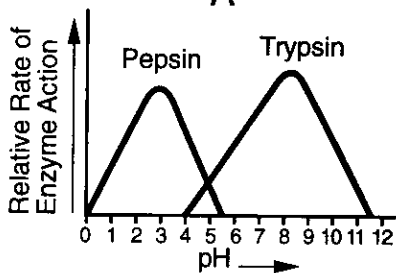
Base your answers to questions 63 and 64 on the graphs below and on your knowledge of biology. The graphs represent human enzyme activity.



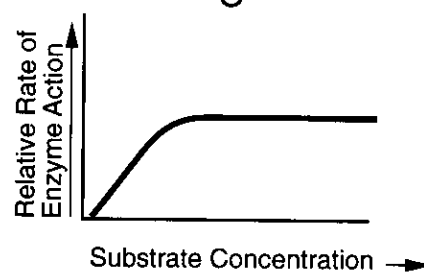
A



C



B



D

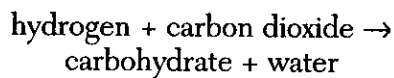
63 Human enzymes would most likely begin to denature at a

- (1) temperature of 40°C
- (2) temperature of 23°C
- (3) pH of 3
- (4) pH of 2

64 Certain enzymes work best within an acidic or a basic environment. This concept is illustrated in graph

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

65 The equation below summarizes some of the reactions involved in a specific biochemical process.



The source of the hydrogen in the equation is most likely

- | | |
|---|----------|
| (1) $\text{C}_6\text{H}_{12}\text{O}_6$ | (3) PGAL |
| (2) H_2O | (4) ATP |

66 A disaccharide combines with water to produce two monosaccharides in the process known as

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

Directions (67–68): For each phrase in questions 67 and 68, select the molecule, chosen from the list below, that is most closely associated with that phrase. Then record its number on the separate answer paper.

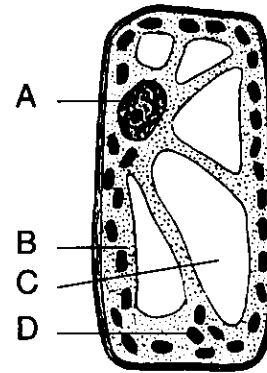
Molecules

- (1) Oxygen
- (2) Pyruvic acid
- (3) Enzymes
- (4) Carbon dioxide
- (5) Water

67 May be converted to lactic acid in anaerobic respiration

68 Controls each reaction in both aerobic and anaerobic respiration

69 In which structure of the cell shown below do photolysis and carbon-fixation reactions occur?

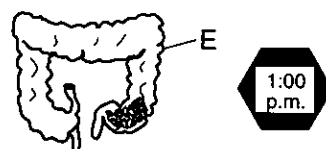
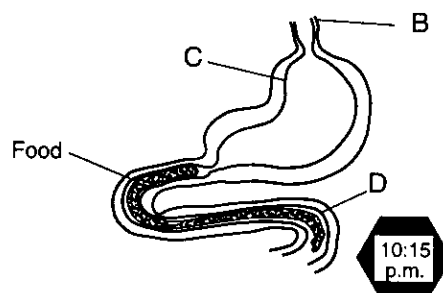
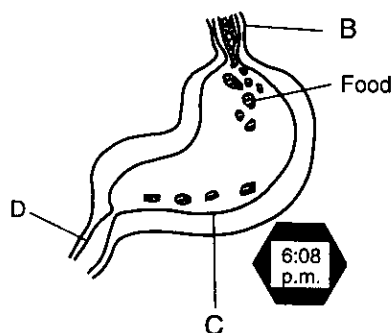
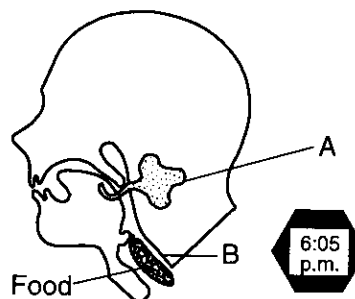
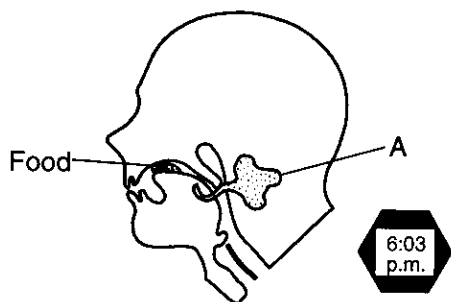


- (1) A
- (2) B
- (3) C
- (4) D

Group 2 — Human Physiology

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

Base your answers to questions 70 through 73 on the diagrams below and on your knowledge of biology. The diagrams illustrate the pathway and the time frame for the digestion of a hamburger consisting of ground beef, ketchup, and a whole-wheat bun.



70 During which period does most of the digestive action of bile and pancreatic juice occur?

- (1) 6:03 p.m. to 6:05 p.m.
- (2) 6:05 p.m. to 6:08 p.m.
- (3) 10:15 p.m. to 9:50 a.m.
- (4) 9:50 a.m. to 1:00 p.m.

71 Hydrolysis of the proteins present in the ground beef usually takes place in structures

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

72 Chemical digestion of the whole-wheat bun begins after hydrolytic enzymes are secreted by structure

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

73 An irritant can cause an erosion in the lining of structure C, leading to a disorder known as

- | | |
|----------------|----------------|
| 1 constipation | 3 gout |
| 2 ulcers | 4 appendicitis |

BIOLOGY

Wednesday, January 28, 1998 — 9:15 a.m. to 12:15 p.m., only

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

Rater's Initials:

ANSWER PAPER

Student Sex: Male Female

Teacher School

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

Part I (65 credits)

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

PART I CREDITS

Directions to Teacher:

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

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

No. right

Part II (20 credits)

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

Group 1
Biochemistry

- 60 1 2 3 4
61 1 2 3 4
62 1 2 3 4
63 1 2 3 4
64 1 2 3 4
65 1 2 3 4
66 1 2 3 4
67 1 2 3 4 5
68 1 2 3 4 5
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
101 1 2 3
102 1 2 3
103 1 2 3 4
104 1 2 3 4
105 1 2 3 4 5 6
106 1 2 3 4 5 6
107 1 2 3 4 5 6
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 groups of questions you do not choose to answer.

Group 1

110 1 2 3 4

111 1 2 3 4

112 1 2 3 4

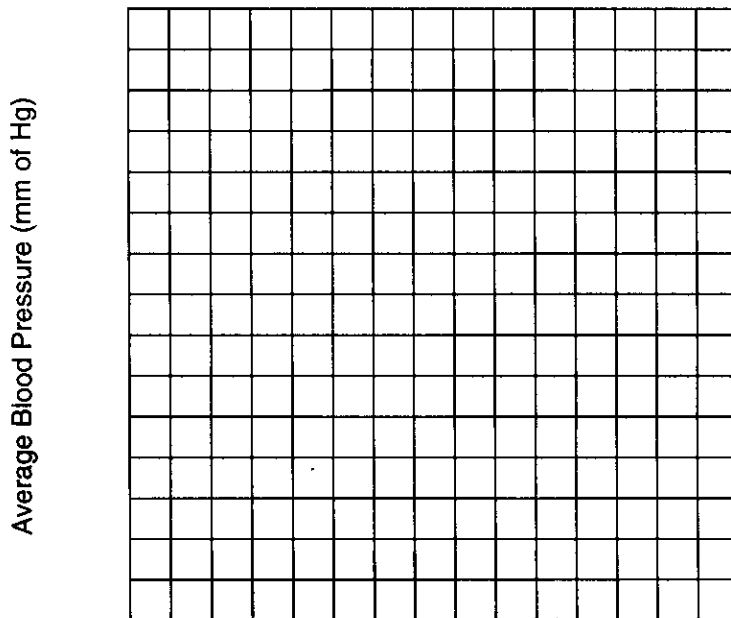
113 _____

114 _____

Group 2

115 – 117

The Effect of Age on Human Blood Pressure



Key

- △ Systolic blood pressure
- Diastolic blood pressure

118 _____

119 _____

Group 3

120 1 2 3 4
121 1 2 3 4
122 1 2 3 4
123 1 2 3 4
124 1 2 3 4

Group 4

125 1 2 3 4
126 1 2 3 4
127 1 2 3 4
128 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

Directions (74–75): For each statement in questions 74 and 75, select the immune response, chosen from the list below, that is most closely associated with that statement. Then record its number on the separate answer paper.

Immune Response

- (1) Active immunity
- (2) Passive immunity
- (3) Allergies
- (4) Tissue rejection

74 A vaccine containing a weakened disease-causing organism is injected into the body.

75 Chemicals known as histamines are released as a result of antibody production.

76 In a human, the transport of blood between the heart and lungs is known as

- 1 systemic circulation
- 2 coronary circulation
- 3 lymphatic circulation
- 4 pulmonary circulation

77 An insufficient amount of hemoglobin is most closely associated with the disorder known as

- | | |
|----------|-----------------------|
| 1 angina | 3 coronary thrombosis |
| 2 anemia | 4 high blood pressure |
-

78 In a certain community, a number of humans have an abnormally enlarged structure under the skin of the lower front side of their necks. The cause of this condition is most likely

- 1 an excess of calcium in the diet, which has caused a muscle deformity
- 2 deposits of fat under the skin caused by a vegetable diet
- 3 inherited neck deformities caused by elevated environmental temperatures
- 4 a lack of iodine in the diet, which has caused the development of a goiter

79 A physiologist removed the pancreas from several dogs in an experiment to investigate its function. He placed five normal dogs in one kennel and five dogs lacking a pancreas in another kennel. The physiologist observed that ants were attracted in large numbers to the kennel of the dogs lacking a pancreas.

Because they lacked a pancreas, what substance did these dogs have that attracted the ants?

- 1 enzymes in their saliva
- 2 sugar in their urine
- 3 mineral salts in their feces
- 4 oil on their fur

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 information in the chart below and on your knowledge of biology.

Stages of the Menstrual Cycle

Stage	Event
A	Periodic shedding of the thickened uterine lining
B	Release of the egg
C	Production of progesterone by tissue in a follicle
D	Maturation of the egg and secretion of estrogen

80 Which structure does the egg that is released in stage *B* normally enter first?

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

81 Which stage is represented by letter *A*?

- | | |
|----------------|-----------------|
| 1 ovulation | 3 follicle |
| 2 menstruation | 4 corpus luteum |

82 Which sequence best represents the order of the stages in the menstrual cycle?

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

83 In human males, sperm cells are suspended in a fluid medium. The main advantage gained from this adaptation is that the fluid

- removes polar bodies from the surface of the sperm
- activates the egg nucleus so that it begins to divide
- acts as a transport medium for sperm
- provides currents that propel the egg down the oviduct

84 The scrotum is an important adaptation in human males because the optimum temperature for sperm development is

- 10 to 12 degrees below normal body temperature
- 2 to 4 degrees below normal body temperature
- 2 to 4 degrees above normal body temperature
- 10 to 12 degrees above normal body temperature

Base your answers to questions 85 and 86 on the list of animals below and on your knowledge of biology.

Animals

- Fish
- Amphibians
- Reptiles
- Birds

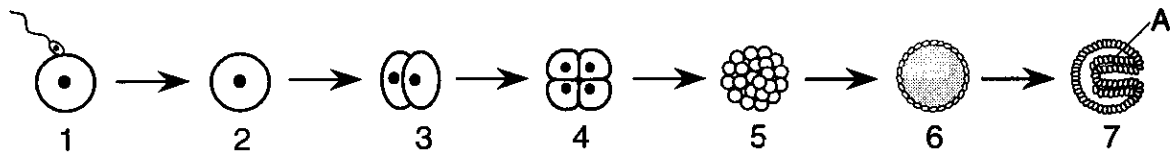
85 The embryos of *C* and *D* are protected from shock by the

- respiratory membranes
- amniotic fluid
- allantois
- umbilical cord

86 Which animals produce eggs that develop in a freshwater environment?

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

Base your answers to questions 87 through 89 on the diagrams below and on your knowledge of biology. The diagrams represent stages in the development of a vertebrate.



87 During a pregnancy, identical twins could result from the

- 1 repetition of the process in stage 1
- 2 implantation of the structure in stage 6
- 3 separation of cells in stage 3
- 4 differentiation of cells in stage 7

89 Which structure does *not* develop from tissue layer A?

- 1 testis
- 2 muscle
- 3 blood vessel
- 4 spinal cord

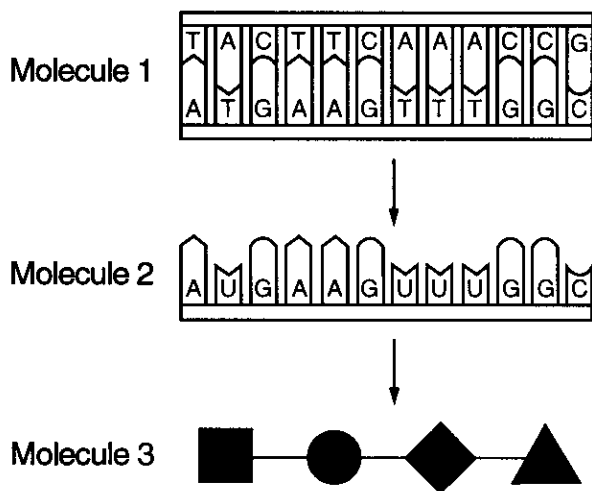
88 Which stage represents the blastula?

- (1) 6
- (2) 2
- (3) 3
- (4) 7

Group 4 — Modern Genetics

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

Base your answers to questions 90 through 93 on the diagram below and on your knowledge of biology. The diagram represents molecules involved in protein synthesis.



90 In plant cells, molecule 1 is found in the

- | | |
|-------------|-------------|
| 1 centriole | 3 cell wall |
| 2 nucleus | 4 lysosome |

91 The building blocks of molecule 3 are known as

- | | |
|-------------------|-------------------|
| (1) amino acids | (3) fatty acids |
| (2) DNA molecules | (4) RNA molecules |

92 Where do the chemical reactions that are coded for by molecule 2 take place?

- 1 in the vacuole
- 2 on the plasma membrane
- 3 in the lysosome
- 4 at ribosomes

93 Molecule 3 is formed as a result of

- | | |
|-------------------------|------------------------|
| 1 deamination | 3 enzymatic hydrolysis |
| 2 dehydration synthesis | 4 oxidation |

94 In some individuals, G–A–G, the codon for glutamic acid, is changed to G–U–G, the codon for valine. This error causes misshapen red blood cells. This genetic disorder is known as

- | | |
|--------------|----------------------|
| 1 albinism | 3 Tay-Sachs |
| 2 hemophilia | 4 sickle-cell anemia |

95 To determine whether a fetus has inherited Down syndrome, a doctor would most likely

- 1 perform amniocentesis and analyze cells removed by this technique
- 2 analyze the fetal blood for phenylalanine
- 3 screen the mother's blood for abnormal cells
- 4 examine the fetal nervous system for the accumulation of fatty material

96 The code of a gene is delivered to the enzyme-producing region of a cell by a

- (1) hormone
- (2) nerve impulse
- (3) messenger RNA molecule
- (4) DNA molecule

97 Which process is most similar to the process of cloning?

- 1 fertilization
- 2 vegetative propagation
- 3 meiosis
- 4 gamete formation

98 Which process could be used by breeders to develop tomatoes with a longer shelf life and to develop cows with increased milk production?

- | | |
|---------------------|-----------------------|
| 1 natural selection | 3 genetic engineering |
| 2 sporulation | 4 chromatography |

99 The gene frequencies in a population would most likely change due to

- | | |
|------------------------|----------------------|
| 1 random mating | 3 a large population |
| 2 a stable environment | 4 mutations |

Group 5 — Ecology

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

Directions (100–102): For *each* symbiotic relationship in questions 100 through 102, select the type of symbiosis, *chosen from the list below*, that best identifies that relationship. Then record its *number* on the separate answer paper. [A number may be used more than once or not at all.]

Types of Symbiosis

- (1) Commensalism
- (2) Mutualism
- (3) Parasitism

- 100 A tapeworm lives in the digestive tract of a human.
- 101 Nitrogen-fixing bacteria live in nodules on the roots of legumes.
- 102 A flea sucks blood from the skin of a dog.

- 103 In the nitrogen cycle, which type of bacteria converts nitrogenous wastes into ammonia?
- 1 bacteria of decay
 - 2 nitrogen-fixing bacteria
 - 3 nitrifying bacteria
 - 4 denitrifying bacteria
- 104 Starting on bare rock, what is the usual ecological succession of organisms?
- 1 grasses → shrubs → lichens → trees
 - 2 lichens → shrubs → grasses → trees
 - 3 grasses → shrubs → lichens → trees
 - 4 lichens → grasses → shrubs → trees

Directions (105–107): For *each* description in questions 105 through 107, select the biome, *chosen from the list below*, that best fits that description. Then record its *number* on the separate answer paper.

Biomes

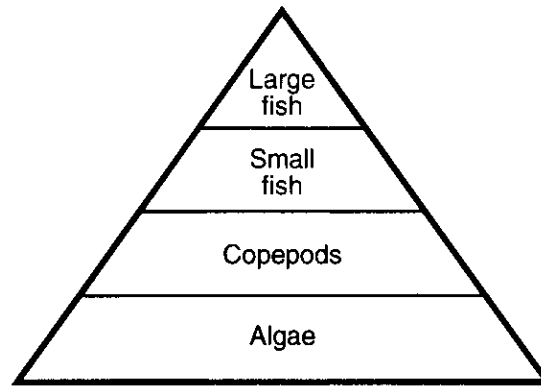
- (1) Tundra
- (2) Taiga
- (3) Temperate deciduous forest
- (4) Grassland
- (5) Desert
- (6) Tropical forest

- 105 Lichens and mosses present; subsoil permanently frozen
- 106 Constant, warm temperature; heavy rainfall
- 107 Wide variation in daily temperature; little rainfall

- 108 Which statement is *not* a correct description of oceans?
- 1 Oceans absorb and hold large quantities of solar heat.
 - 2 Oceans provide the least stable aquatic environment.
 - 3 Oceans contain a relatively constant supply of nutrient materials and dissolved salts.
 - 4 Oceans serve as a habitat for a large number of diverse organisms.

GO RIGHT ON TO THE NEXT PAGE. 

109 The diagram below represents a pyramid of biomass in an aquatic environment.



Which statement best explains why mass decreases from one level to the next in this pyramid?

- 1 More organisms die at higher levels than at lower levels, resulting in less mass at higher levels.
 - 2 When organisms die at higher levels, their remains sink to lower levels, increasing the mass at lower levels.
 - 3 Energy is lost to the environment at each level, so less mass can be supported at succeeding higher levels.
 - 4 Organisms decay at each level, and thus less mass can be supported at succeeding higher levels.
-

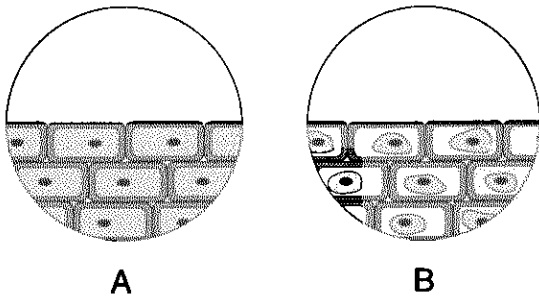
Part III

This part consists of five groups. Choose three of these five groups. For those questions that are followed by four choices, record the answers on the separate answer paper in accordance with the directions on the front page of this booklet. For all other questions in this part, record your answers in accordance with the directions given in the question. [15]

Group I

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

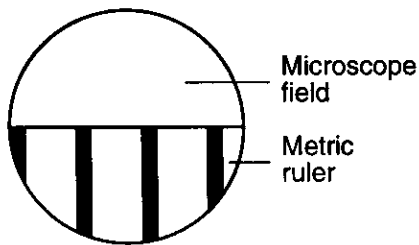
110 A student observed a wet mount of some stained plant cells in the high-power field of a compound light microscope. Diagram A represents the general appearance of these cells. The student then added several drops of a liquid to the wet mount and continued the observations. Diagram B represents the general appearance of the cells a few minutes after adding the liquid.



The liquid that the student added to the wet mount was most likely

- | | |
|-------------------|--------------|
| 1 salt water | 3 pond water |
| 2 distilled water | 4 tap water |

111 Each division of the metric ruler shown in the diagram below equals 1 millimeter.



The diameter of the field of vision is approximately

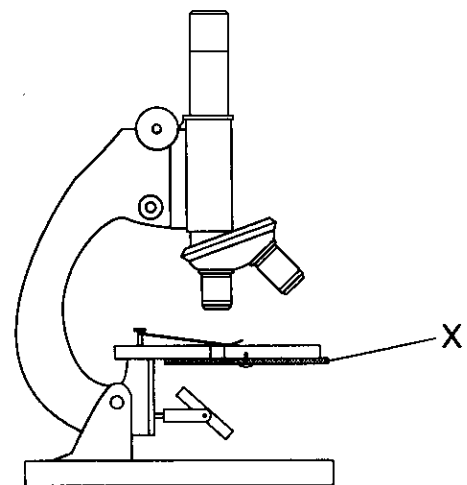
- | | |
|-------------------------|-------------------------|
| (1) 2,800 μm | (3) 4,400 μm |
| (2) 3,700 μm | (4) 4,700 μm |

112 A student adds several drops of iodine solution to a sample of onion tissue. Which cell component would become more visible under low power of a compound light microscope as a result of this procedure?

- 1 centriole
- 2 Golgi complex
- 3 deoxyribonucleic acid
- 4 nucleus

113 Using one or more complete sentences, explain why a student should focus only with the fine adjustment when observing muscle tissue with the high-power objective of a compound light microscope. You may use pen or pencil for your answer.

114 Using one or more complete sentences, state the function of structure X represented in the diagram below. You may use pen or pencil for your answer.



Group 2

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

Base your answers to questions 115 through 118 on the information and data table below and on your knowledge of biology. The table shows the average systolic and diastolic blood pressure measured in millimeters of mercury (Hg) for humans between the ages of 2 and 14 years.

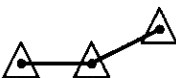
Data Table

Age	Average Blood Pressure (mm of Hg)	
	Systolic	Diastolic
2	100	60
6	101	64
10	110	72
14	119	76

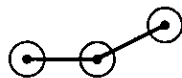
Directions (115–117): Using the information in the data table, construct a line graph on the grid provided on your answer paper, following the directions below. The grid on the next page is provided for practice purposes only. Be sure your final answer appears on your answer paper. You may use pen or pencil for your answer.

115 Mark an appropriate scale on each labeled axis.

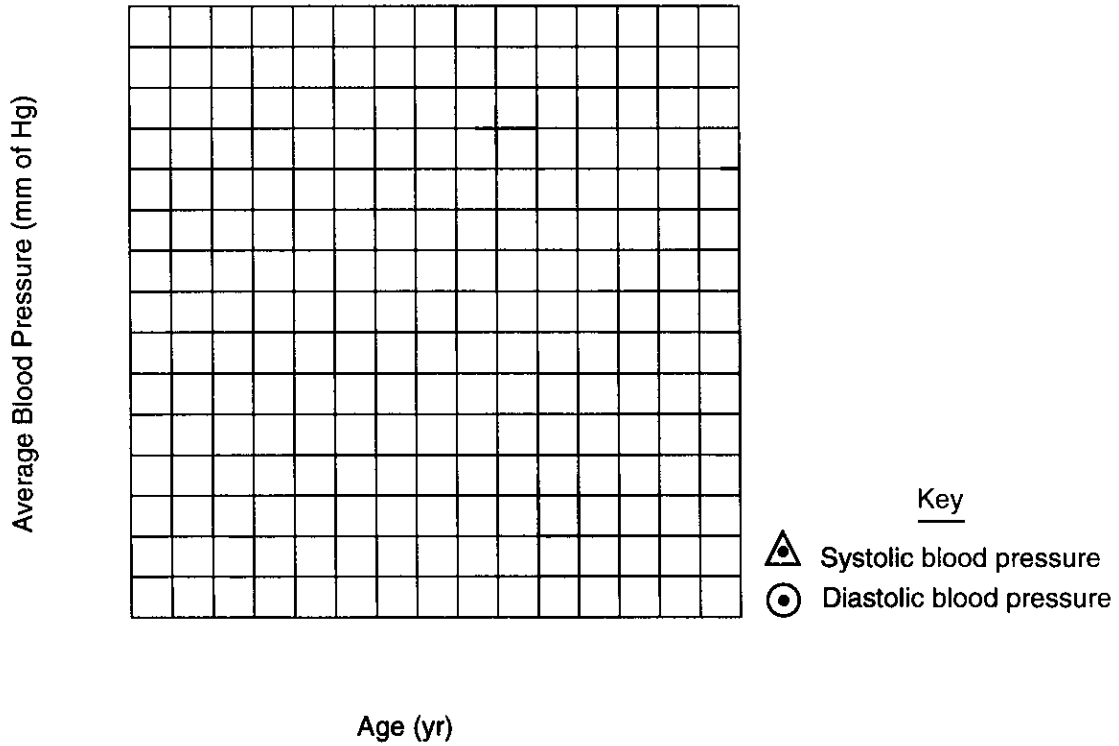
116 Plot the data for systolic blood pressure on your graph. Surround each point with a small triangle and connect the points.

Example: 

117 Plot the data for diastolic blood pressure on your graph. Surround each point with a small circle and connect the points.

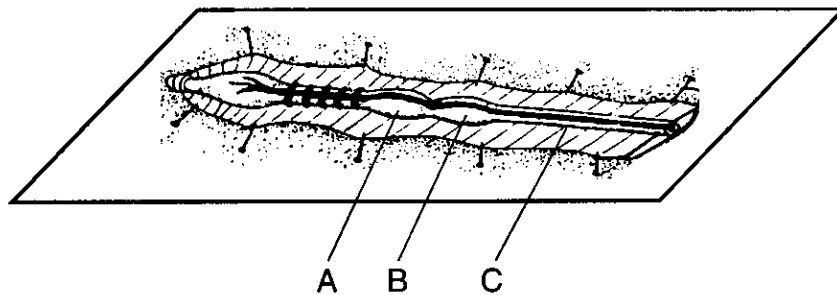
Example: 

The Effect of Age on Human Blood Pressure

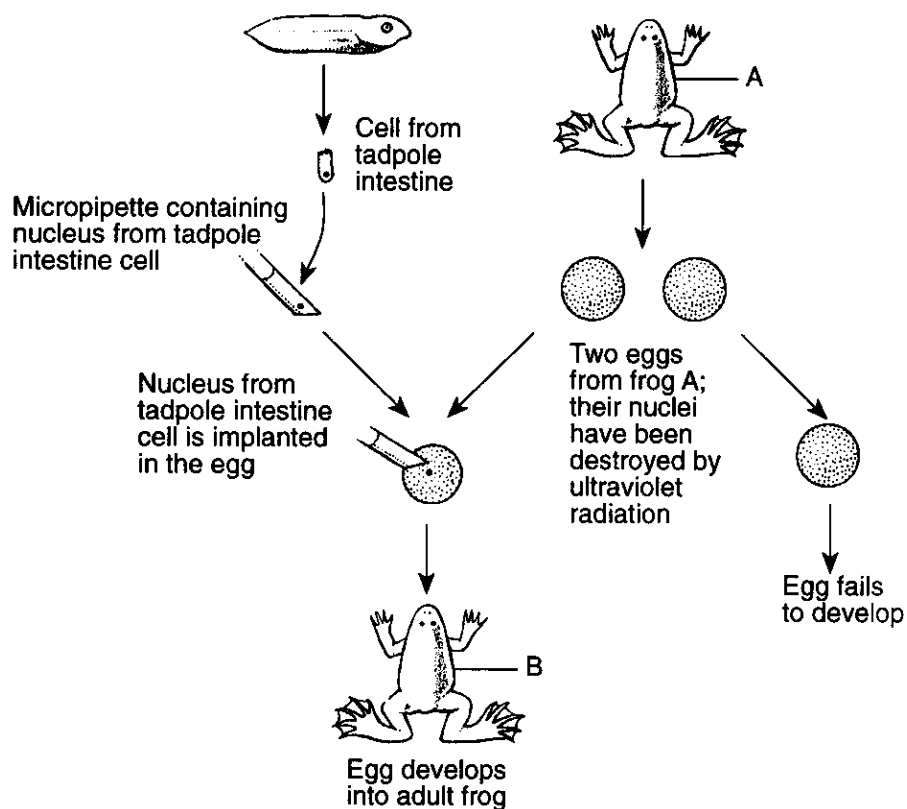


118 Using one or more complete sentences, state one conclusion that compares systolic blood pressure to diastolic blood pressure in humans between the ages of 2 and 14 years. You may use pen or pencil for your answer.

119 The diagram below shows an earthworm that has been dissected. Select one of the lettered structures from the diagram. Record the letter of this structure and, using one or more complete sentences, state a digestive function of this structure. You may use pen or pencil for your answer.



124 An experiment is represented in the diagram below.



An inference that can be made from this experiment is that

- 1 adult frog *B* will have the same genetic traits as the tadpole
 - 2 adult frog *A* can develop only from an egg and a sperm
 - 3 fertilization must occur in order for frog eggs to develop into adult frogs
 - 4 the nucleus of a body cell fails to function when transferred to other cell types
-

Group 4

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

125 The charts below show the relationship of recommended weight to height in men and women age 25–29.

Height–Weight Charts

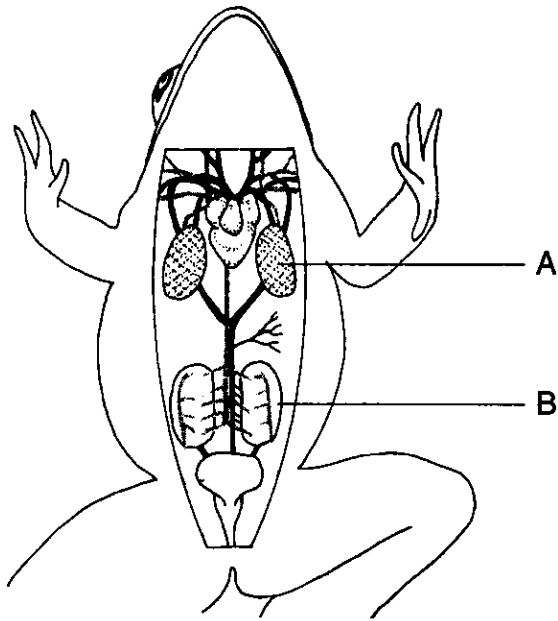
MEN Age 25–29				
Weight (lb)				
Height		Small Frame	Medium Frame	Large Frame
Feet	Inches			
5	2	128–134	131–141	138–150
5	3	130–136	133–143	140–153
5	4	132–138	135–145	142–156
5	5	134–140	137–148	144–160
5	6	136–142	139–151	146–164
5	7	138–145	142–154	149–168
5	8	140–148	145–157	152–172
5	9	142–151	148–160	155–176
5	10	144–154	151–163	158–180
5	11	146–157	154–166	161–184
6	0	149–160	157–170	164–188
6	1	152–164	160–174	168–192
6	2	155–168	164–178	172–197
6	3	158–172	167–182	176–202
6	4	162–176	171–187	181–207

WOMEN Age 25–29				
Weight (lb)				
Height		Small Frame	Medium Frame	Large Frame
Feet	Inches			
4	10	102–111	109–121	118–131
4	11	103–113	111–123	120–134
5	0	104–115	113–126	122–137
5	1	106–118	115–129	125–140
5	2	108–121	118–132	128–143
5	3	111–124	121–135	131–147
5	4	114–127	124–138	134–151
5	5	117–130	127–141	137–155
5	6	120–133	130–144	140–159
5	7	123–136	133–147	143–163
5	8	126–139	136–150	146–167
5	9	129–142	139–153	149–170
5	10	132–145	142–156	152–173
5	11	135–148	145–159	155–176
6	0	138–151	148–162	158–179

The recommended weight for a 6'0"-tall man with a small frame is closest to that of a

- (1) 5'10" man with a medium frame
- (2) 5'9" woman with a large frame
- (3) 6'0" man with a medium frame
- (4) 6'0" woman with a medium frame

126 A frog dissection is represented in the diagram below.



Which statement best describes the relationship of structure *A* to structure *B*?

- (1) *A* is posterior to *B*.
- (2) *A* is dorsal to *B*.
- (3) *B* is posterior to *A*.
- (4) *B* is ventral to *A*.

127 Zebra finches are small black-and-white birds that lay eggs about the size of a bean seed. Which unit of measurement is best for accurately measuring the length of these eggs?

- | | |
|---------------|----------|
| 1 millimeters | 3 feet |
| 2 micrometers | 4 meters |

128 Which procedure would be part of a laboratory investigation designed to determine if a specific nutrient is present in a food?

- 1 test a moist sample of the food with pH paper
- 2 add Lugol's iodine solution to a sample of the food
- 3 place a sample of the food in a test tube containing methylene blue
- 4 add bromthymol blue to a sample of the food

129 What is the first step of a scientific investigation?

- 1 perform the experiment
- 2 analyze the experimental data
- 3 formulate a hypothesis
- 4 state the problem

Group 5

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

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

Female or Male, Which Will It Be?

After fertilization, *all* human embryos begin forming the basic female reproductive structures. These structures are present by the time the embryo has toes, fingers, eyes, and a heart at 35–40 days into gestation. If the egg was fertilized by a sperm containing a Y-chromosome, a series of changes occurs that will produce a male.

Recent research has isolated a genetic switching mechanism that is part of the process that determines sex in humans. The Y-chromosome contains a trigger factor known as the *SRY* gene, which activates the male pattern of development after 35–40 days of gestation. The *SRY* gene causes testes to develop. These, in turn, produce testosterone, which causes the development of male characteristics such as the penis, masculine muscles, and eventually, facial hair.

At this stage of development, the embryo has both male and female potential. However, the *SRY* gene sends a chemical message to another gene known as *MIS*. The *MIS* gene causes the developing female organs in the embryo to disappear. The combined action of the *SRY* and *MIS* genes results in the change of the embryo from female to male.

130 During the first five weeks after a human egg is fertilized, the embryo develops

- 1 only toes, fingers, eyes, and a heart
- 2 male reproductive structures and other organs
- 3 female reproductive structures and other organs
- 4 male or female reproductive structures, depending on whether the egg was fertilized by an X-bearing or a Y-bearing sperm

131 The male pattern of development is activated by the

- (1) *SRY* gene
- (2) entire Y-chromosome
- (3) entire X-chromosome
- (4) *MIS* gene

132 The *MIS* gene is activated by

- 1 the X-chromosome
- 2 a chemical message
- 3 the presence of male reproductive structures
- 4 the presence of female reproductive structures

133 An embryo is changed from a female to a male by the action of

- (1) two X-chromosomes
- (2) all the genes on a Y-chromosome
- (3) an *MIS* gene, only
- (4) *SRY* and *MIS* genes

134 Using one or more complete sentences, state one safety procedure that a student should follow when dissecting a preserved frog. You may use pen or pencil for your answer.
