

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

BIOLOGY

Thursday, June 24, 1999 — 9:15 a.m. to 12:15 p.m., only

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SAMPLE: ① 2 3 4

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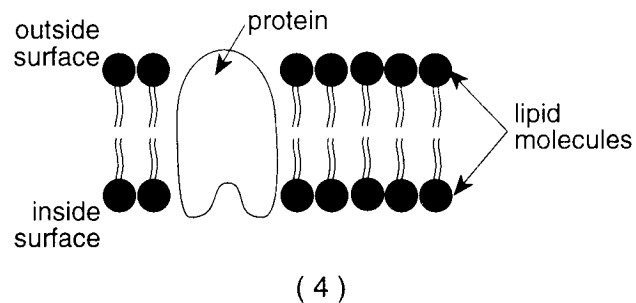
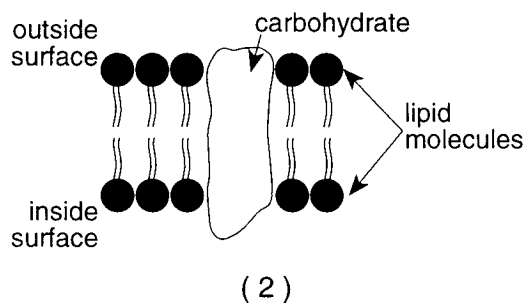
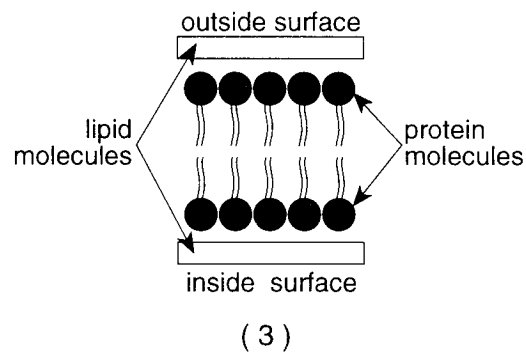
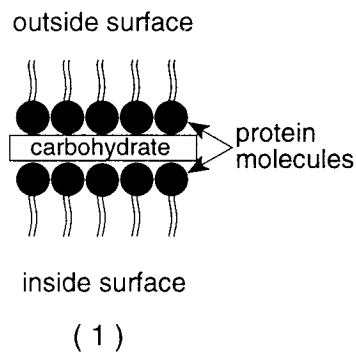
SAMPLE: ⊗ 2 3 4

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

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10 Which diagram best represents the fluid-mosaic model of a cell membrane?



11 Under certain conditions, the openings of stomates in leaves become smaller. This process enables the plant to avoid excessive loss of

- | | |
|---------|------------|
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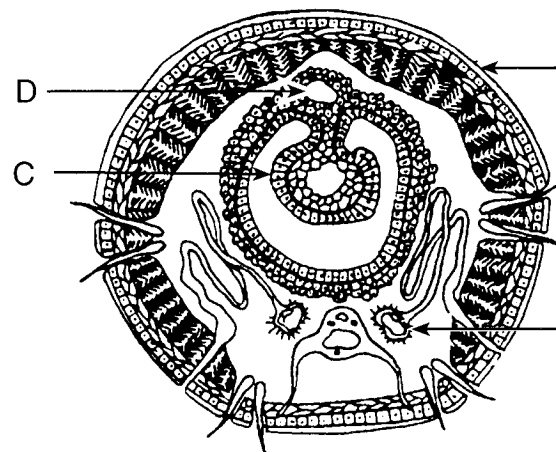
12 Filaments known as rhizoids extend from bread mold, penetrate bread, and digest the bread by secreting substances known as

- | | |
|------------|------------|
| 1 vitamins | 3 hormones |
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13 The root system of a grass plant is an adaptation that increases the ability of the plant to

- | |
|---|
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| 3 manufacture pigments for protection |
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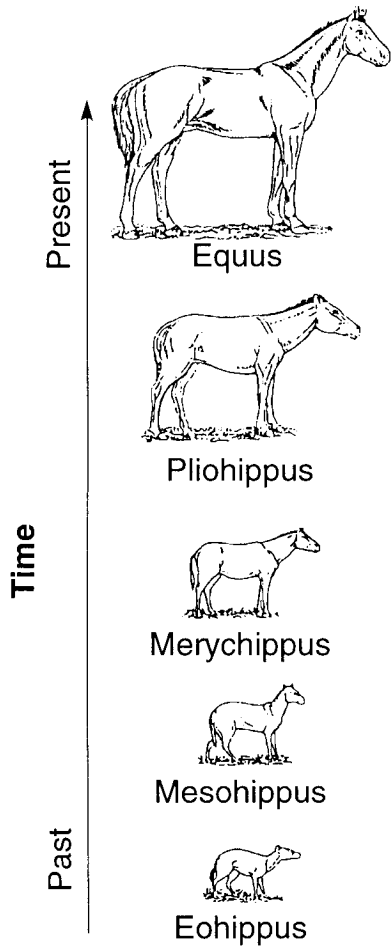
14 The diagram below represents the cross section of an earthworm.



Which letter indicates a structure that provides an increased surface area for the absorption of digestive end products?

- | | |
|-------|-------|
| (1) A | (3) C |
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50 The diagram below shows the gradual change over time in the anatomy of the horse.



Which concept is best illustrated by the physical variations in the horse as its body size and structure change over time?

- 1 acquired characteristics
- 2 artificial selection
- 3 intermediate inheritance
- 4 organic evolution

51 A change in genetic material that produces a variation in a species may be a result of

- 1 a mutation
- 2 competition
- 3 overproduction of a species
- 4 a struggle for survival

52 According to the heterotroph hypothesis, the atmosphere of primitive Earth lacked

- | | |
|--------------|----------------|
| 1 oxygen gas | 3 ammonia |
| 2 water | 4 hydrogen gas |

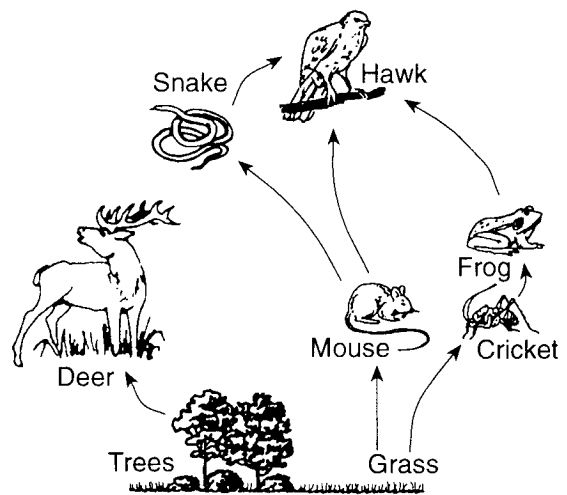
53 The most likely result of a group of squirrels relying on limited resources would be

- 1 an increase in the number of squirrels
- 2 competition between the squirrels
- 3 increased habitats for the squirrels
- 4 a greater diversity of food for the squirrels

54 Which element is *not* recycled throughout an ecosystem by the processes of photosynthesis and respiration?

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

55 Nutritional relationships between organisms are shown in the diagram below.



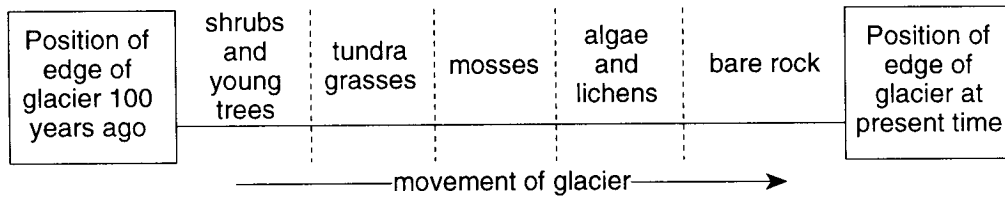
Which organisms are primary consumers?

- 1 mouse, snake, and hawk
- 2 snake, hawk, and frog
- 3 cricket, frog, and deer
- 4 mouse, deer, and cricket

56 Farmers sometimes release praying mantises into their fields to consume other insects that destroy crops. This action is an example of

- 1 biological control of insect pests
- 2 chemical control of insect pests
- 3 a technological oversight
- 4 exploitation of wildlife

59 The diagram below represents a map showing different zones in an area once covered by a glacier.



This map best represents

- 1 a food chain
 - 2 ecological succession
 - 3 a pyramid of energy
 - 4 nutritional relationships
-

Base your answers to questions 66 through 68 on the table below and on your knowledge of biology.

Enzyme	Effective Temperature Range (°C)	Optimum pH
A	60–80	3
B	30–40	3.5
C	20–38	9
D	20–27	7

66 If enzyme C is functioning at 25°C and a pH of 7, under which conditions would the rate of enzyme action probably increase?

- 1 The temperature is decreased to 22°C and the pH is kept the same.
- 2 The temperature is increased to 30°C and the pH is increased to 8.
- 3 The temperature is kept the same and the pH is decreased to 6.
- 4 The temperature is increased to 44°C and the pH is kept the same.

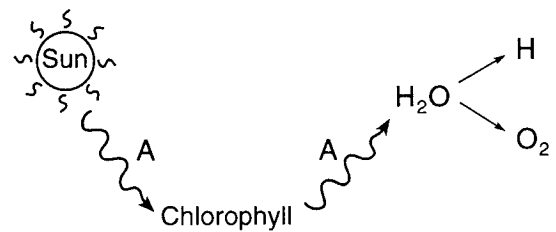
67 At what temperature would enzyme D most likely be denatured?

- | | |
|----------|----------|
| (1) 15°C | (3) 25°C |
| (2) 20°C | (4) 39°C |

68 Which enzyme would most likely be functional in bacteria living in a hot spring that is 35°C above normal human body temperature?

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

69 The diagram below represents some chemical events that take place in one type of autotrophic nutrition.



The arrows labeled A best represent

- | | |
|------------------|---------------|
| 1 carbon dioxide | 3 energy |
| 2 glucose | 4 lactic acid |

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Part I

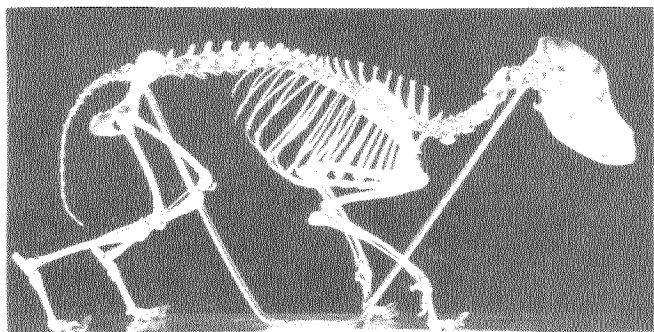
Answer all 59 questions in this part. [65]

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 When a duck dives into cold water, the capillaries in its skin constrict and move deeper below the surface of the skin. This reaction is an example of

- | | |
|---------------|---------------|
| 1 homeostasis | 3 respiration |
| 2 synthesis | 4 excretion |

2 The remains of an organism are shown in the photograph below.



This organism is classified as

- | | |
|------------------|----------------|
| 1 a coelenterate | 3 a chordate |
| 2 an annelid | 4 an arthropod |

3 Which instrument was used in the 18th and 19th centuries and helped scientists develop the cell theory?

- 1 light microscope
- 2 ultracentrifuge
- 3 electron microscope
- 4 microdissecting apparatus

4 Which organelle is correctly paired with its function?

- 1 nucleus — provides carbohydrates for fermentation
- 2 chloroplast — serves as a site for photosynthesis
- 3 centriole — synthesizes digestive enzymes
- 4 lysosome — packages cellular products

5 The phrase “is not a cell but has the ability to reproduce within a living cell” can be used to describe

- | | |
|-----------|---------------|
| 1 an alga | 3 a bacterium |
| 2 a yeast | 4 a virus |

6 Which compound is inorganic?

- 1 glucose ($C_6H_{12}O_6$)
- 2 carbon dioxide (CO_2)
- 3 ethane (C_2H_6)
- 4 stearic acid ($C_{18}H_{36}O_2$)

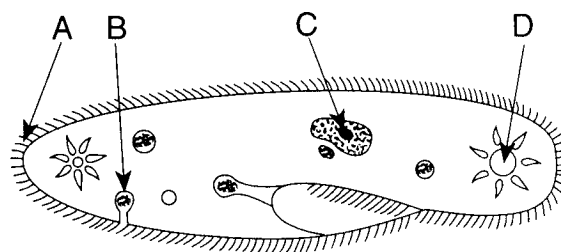
7 Salivary amylase is an enzyme in humans that breaks down starch. The optimum pH for this reaction is 6.7. The rate of this reaction would *not* be affected by

- 1 decreasing the temperature of the reaction by $5^\circ C$
- 2 enzyme concentration
- 3 maintaining the pH of the reaction at 6.7
- 4 substrate concentration

8 Which process is a form of autotrophic nutrition?

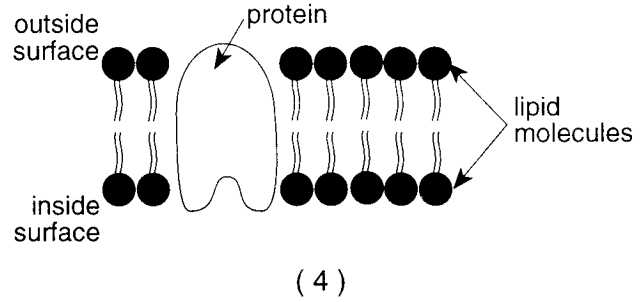
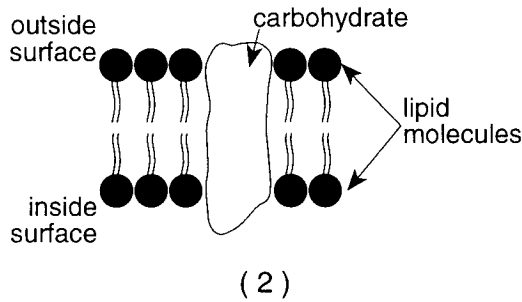
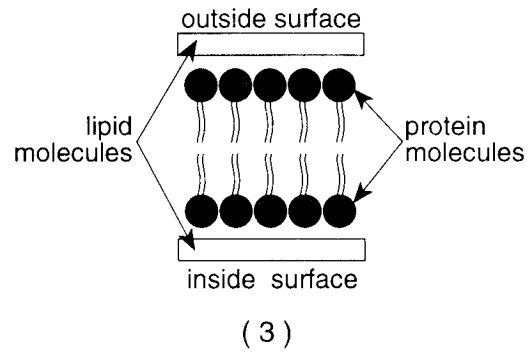
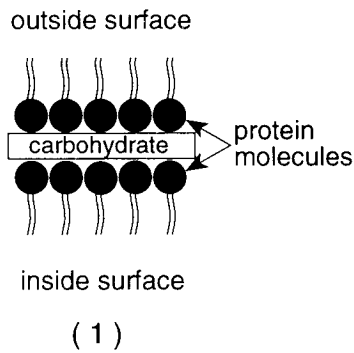
- | | |
|--------------|------------------|
| 1 transport | 3 fermentation |
| 2 regulation | 4 photosynthesis |

9 Which structure indicated in the diagram of a paramecium below is used for the process of egestion?



- | | |
|-------|-------|
| (1) A | (3) C |
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10 Which diagram best represents the fluid-mosaic model of a cell membrane?



11 Under certain conditions, the openings of stomates in leaves become smaller. This process enables the plant to avoid excessive loss of

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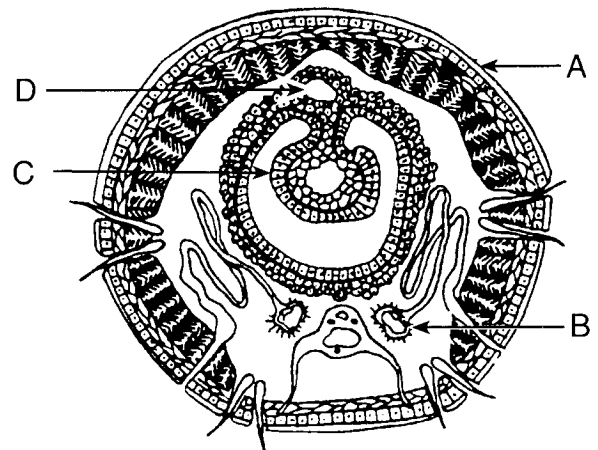
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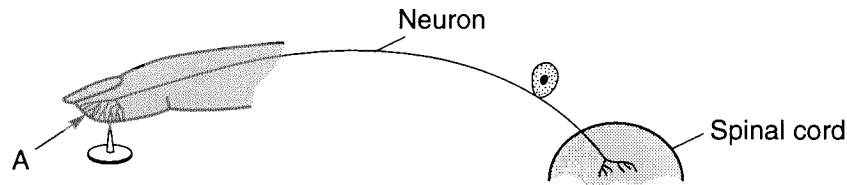
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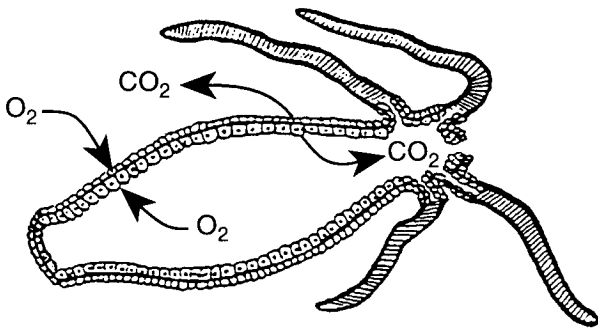
15 A portion of a reflex arc is represented in the diagram below.



The function of structure A is to

- 1 synthesize neurotransmitters
- 2 detect changes in the external environment
- 3 carry messages away from the central nervous system
- 4 directly initiate an impulse in an effector

16 The diagram below represents a hydra.



The movement of gases indicated by the arrows in the diagram takes place by the process of

- 1 pinocytosis
- 2 diffusion
- 3 active transport
- 4 dehydration synthesis

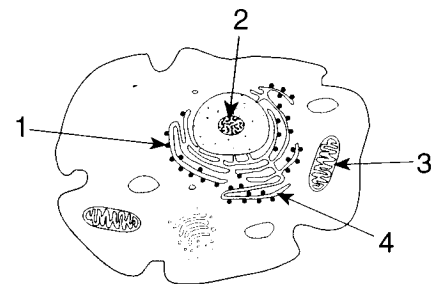
17 Which substances are metabolic waste products excreted by animals?

- 1 oxygen, ammonia, and salts
- 2 glucose, urea, and carbon dioxide
- 3 uric acid, oxygen, and water
- 4 water, urea, and carbon dioxide

18 In certain invertebrates, the function of Malpighian tubules and nephridia is to

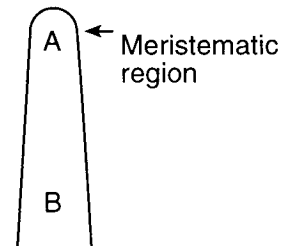
- 1 collect waste materials
- 2 carry oxygen
- 3 transmit nerve impulses
- 4 synthesize proteins

19 In the diagram of a cell shown below, which number indicates the structure in which most of the enzymes involved in aerobic cellular respiration function?



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

20 The diagram below represents the tip of a growing plant stem.



Which statement best describes the auxins in this stem?

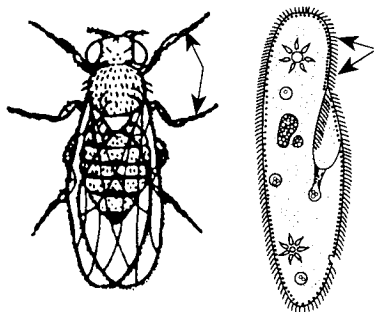
- 1 They are produced at area A and only affect area A.
- 2 They are produced at area B and only affect area B.
- 3 They are produced at area A and transported to area B.
- 4 They are produced at area B and transported to area A.

21 Which row in the chart below contains a correct comparison between nervous regulation and chemical regulation?

Row	Nervous Regulation	Chemical Regulation
A	Slow response	Fast response
B	Long duration	Short duration
C	Involves neuro-transmitters	Involves hormones
D	Common to all organisms	Only in multi-cellular animals

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

22 Two organisms are represented in the diagram below.



The arrows in the diagram indicate structures that help these organisms to

- 1 obtain food
- 2 carry out photosynthesis
- 3 carry out respiration
- 4 excrete wastes

23 Which substance is a nutrient in the human diet?

- 1 oxygen
- 2 carbon dioxide
- 3 water
- 4 roughage

24 After food enters the small intestine, lipases, proteases, and amylases are secreted into the small intestine by the

- 1 liver
- 2 gallbladder
- 3 salivary glands
- 4 pancreas

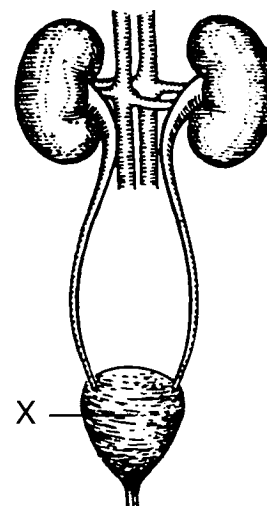
25 Structures specialized for returning blood to the heart are known as

- 1 arteries
- 2 veins
- 3 lacteals
- 4 bronchioles

26 An individual running a marathon may experience periods of oxygen deprivation that can lead to

- 1 anaerobic respiration in muscle cells, forming lactic acid
- 2 aerobic respiration in muscle cells, generating glycogen
- 3 anaerobic respiration in liver cells, producing glucose
- 4 aerobic respiration in liver cells, synthesizing alcohol

27 What is the principal function of the excretory structure indicated by letter X in the diagram below?



- 1 reabsorption
- 2 filtration
- 3 storage
- 4 egestion

28 When a child runs to his mother after hearing a clap of thunder, the child is using

- 1 the central nervous system, only
- 2 the peripheral nervous system, only
- 3 both the central and the peripheral nervous systems
- 4 neither the central nor the peripheral nervous system

29 The humerus, the bone in the upper arm of a human, is directly connected to other bones in the arm by

- 1 cartilage
- 2 tendons
- 3 extensors
- 4 ligaments

30 The chart below provides information about the flowers of three different plants.

Flower Characteristic	Flowers		
	Plant A	Plant B	Plant C
Petal color	white	purple	bright yellow
Aroma	none	rotting meat, strong	sweet, strong
Petal size	0.3 cm	10 cm	4 cm
Nectar amount	none	medium amount	large amount

Which inference is valid concerning the method of pollination for plants A, B, and C?

- 1 All three plants are insect pollinated.
- 2 Plant A is wind pollinated, but plants B and C are insect pollinated.
- 3 Plants A and B are insect pollinated, but plant C is wind pollinated.
- 4 All three plants are wind pollinated.

31 One difference between cell division in plant cells and in animal cells is that

- 1 plants form a cell plate between daughter cells but animals do not
- 2 more cytoplasm forms in animal cells than in plant cells
- 3 centrioles form in plant cells but not in animal cells
- 4 a double nucleus forms in animal cells but not in plant cells

32 Which human disorder is characterized by a group of abnormal body cells that suddenly begin to undergo cell division at a very rapid rate?

- | | |
|------------|-------------------|
| 1 albinism | 3 hemophilia |
| 2 cancer | 4 color blindness |

33 Which process normally occurs during meiosis, but *not* during mitosis?

- 1 chromosomal replication
- 2 synapsis of chromosomes
- 3 spindle formation
- 4 centromere replication

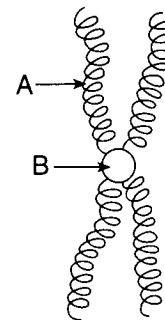
34 Which process produces polar bodies that eventually degenerate?

- | | |
|-------------------|---------------|
| 1 oogenesis | 3 cytokinesis |
| 2 spermatogenesis | 4 cleavage |

35 The bacterium *Clostridium tetani* is found on nearly all surfaces. A short time after one or two of these bacteria enter a wound, a large number of them may be found in the wound as a result of

- 1 regeneration
- 2 vegetative propagation
- 3 asexual reproduction
- 4 gametogenesis

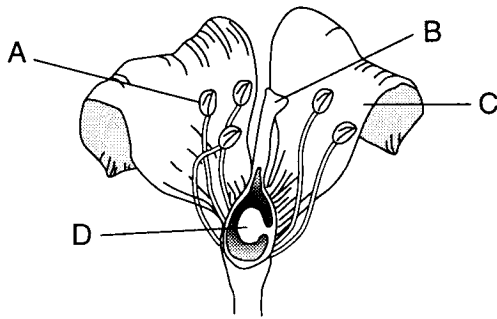
36 The diagram below represents a microscopic structure observed during cell division.



Which parts of the structure are indicated by arrows A and B, respectively?

- 1 centriole and tetrad
- 2 autosome and allele
- 3 homologous chromosome and spindle fiber
- 4 chromatid and centromere

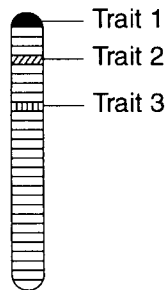
37 A diagram of a flower is shown below.



Fertilization occurs in region

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

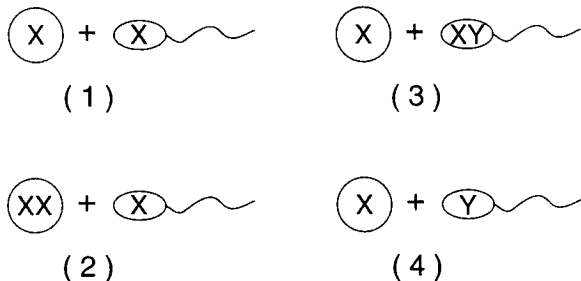
38 A structure found in the nucleus of a cell is shown in the diagram below.



The information contained in the diagram best illustrates the

- 1 law of segregation
- 2 concept of nondisjunction
- 3 gene-chromosome theory
- 4 theory of natural selection

39 Which diagram illustrates fertilization that would most likely lead to the development of a normal human female?



40 A mother with type B blood and a father with type A blood have four children, each with a different blood type. The best explanation for the occurrence of the four different blood types of the children is that blood type is

- 1 only determined by dominant alleles
- 2 determined by multiple alleles
- 3 influenced by environmental conditions
- 4 a sex-linked trait

41 Which statement best describes a chromosomal alteration?

- 1 It never affects the phenotype of an organism.
- 2 It may affect the phenotype of an organism.
- 3 It always produces a recessive genotype in an organism.
- 4 It never has an effect on the genotype of an organism.

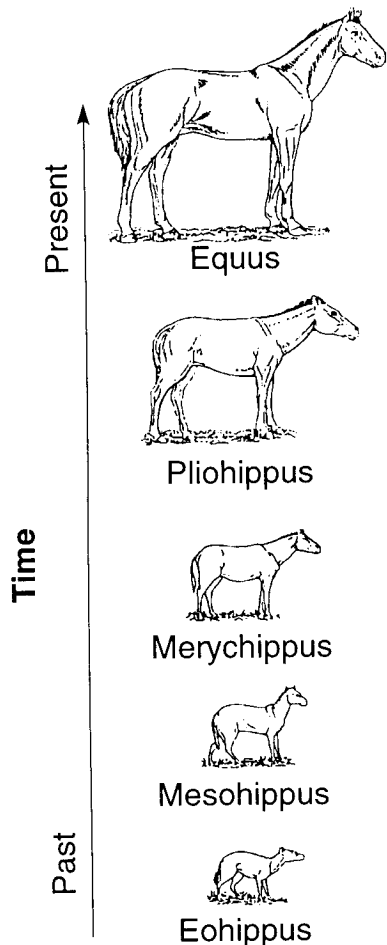
42 A cattle breeder wished to develop a strain of cattle that would produce large quantities of meat per animal. He chose a bull and a cow that most nearly met his goals for breed size. From their calves, he again chose the male and female offspring that most nearly met his goals. After several generations of this style of breeding, the breeder developed a herd of high-yield cattle. In order to maintain this herd of high-yield cattle, which technique should the cattle breeder use?

- 1 vegetative propagation
- 2 hybridization
- 3 genetic recombination
- 4 inbreeding

43 A DNA nucleotide is composed of

- 1 carbon, hydrogen, oxygen, nitrogen, and phosphorus
- 2 carbon, hydrogen, nitrogen, sulfur, and calcium
- 3 calcium, hydrogen, oxygen, phosphorus, and iron
- 4 oxygen, hydrogen, phosphorus, sulfur, and iron

50 The diagram below shows the gradual change over time in the anatomy of the horse.

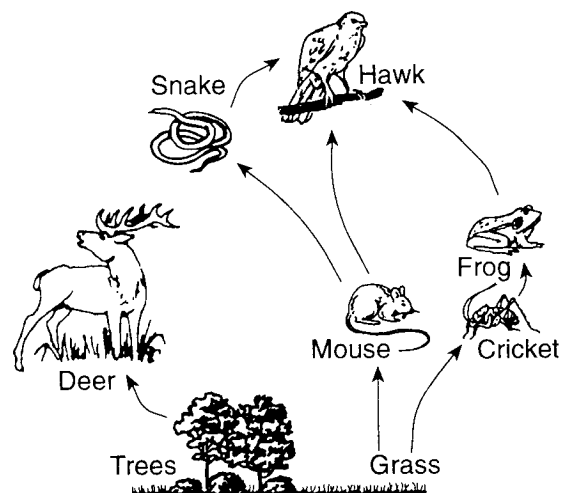


Which concept is best illustrated by the physical variations in the horse as its body size and structure change over time?

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 - 2 artificial selection
 - 3 intermediate inheritance
 - 4 organic evolution
- 51 A change in genetic material that produces a variation in a species may be a result of
- 1 a mutation
 - 2 competition
 - 3 overproduction of a species
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- 52 According to the heterotroph hypothesis, the atmosphere of primitive Earth lacked
- | | |
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| 1 oxygen gas | 3 ammonia |
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53 The most likely result of a group of squirrels relying on limited resources would be

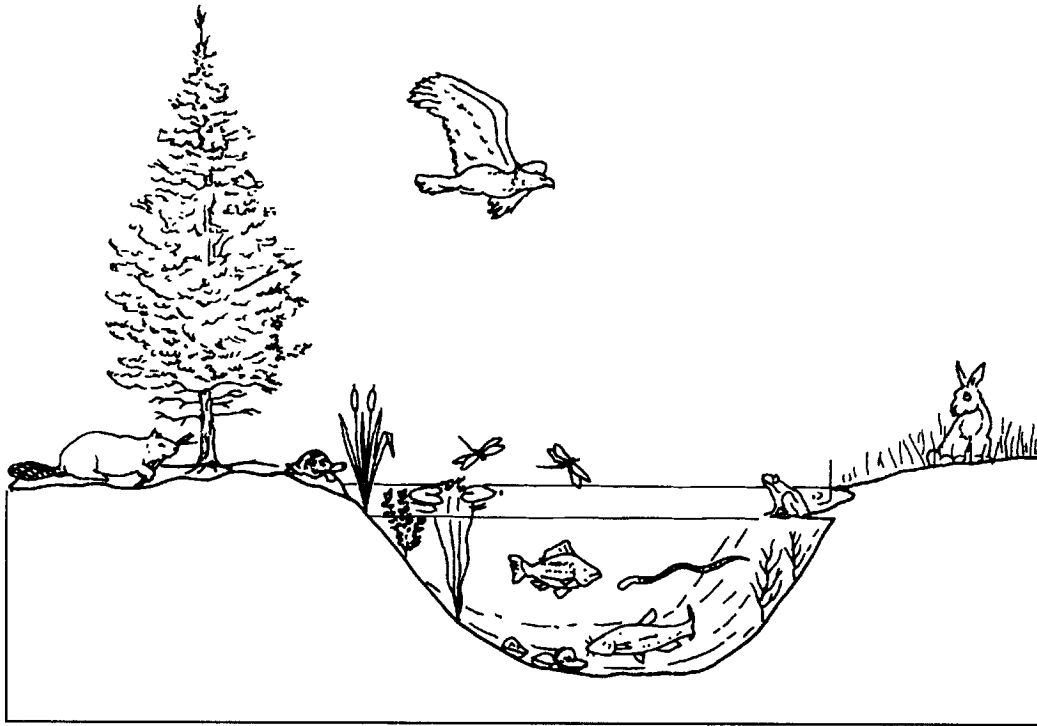
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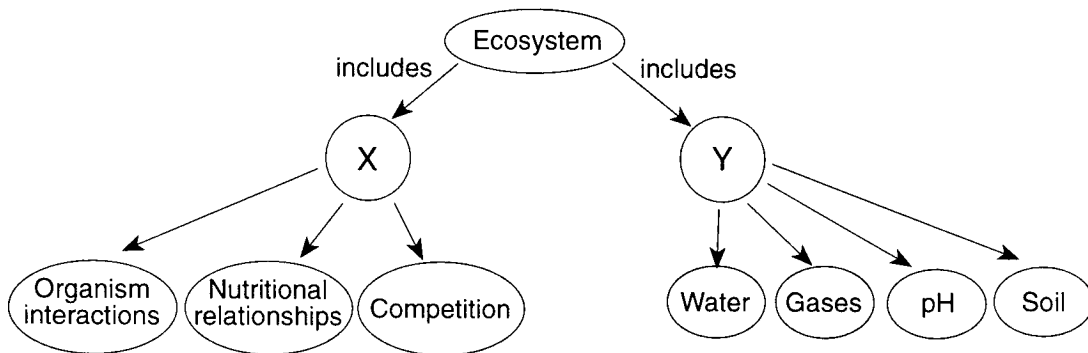
57 The diagram below shows organisms in and around a pond.



Which ecological term refers to all the organisms shown in the diagram?

- | | |
|---------------|--------------|
| 1 heterotroph | 3 population |
| 2 community | 4 producer |

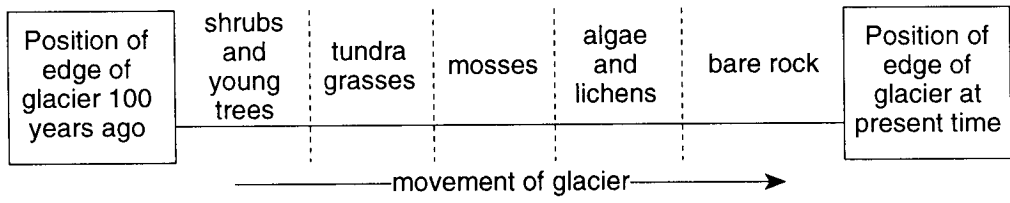
58 Information relating to an ecosystem is contained in the diagram shown below.



Which information belongs in areas X and Y?

- (1) X — biotic factors; Y — abiotic factors
- (2) X — ecological relationships; Y — biotic relationships
- (3) X — abiotic factors; Y — interacting populations
- (4) X — energy flow; Y — biotic factors

59 The diagram below represents a map showing different zones in an area once covered by a glacier.



This map best represents

- 1 a food chain
- 2 ecological succession
- 3 a pyramid of energy
- 4 nutritional relationships

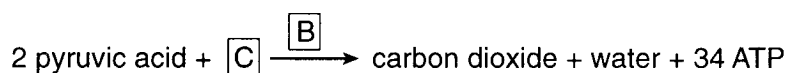
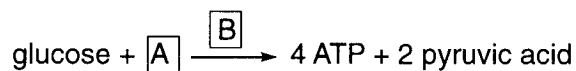
Part II

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 biochemical reactions below and on your knowledge of biology.



60 Letter A represents

- | | |
|--------------|--------------------|
| (1) hydrogen | (3) carbon dioxide |
| (2) 2 DNA | (4) 2 ATP |

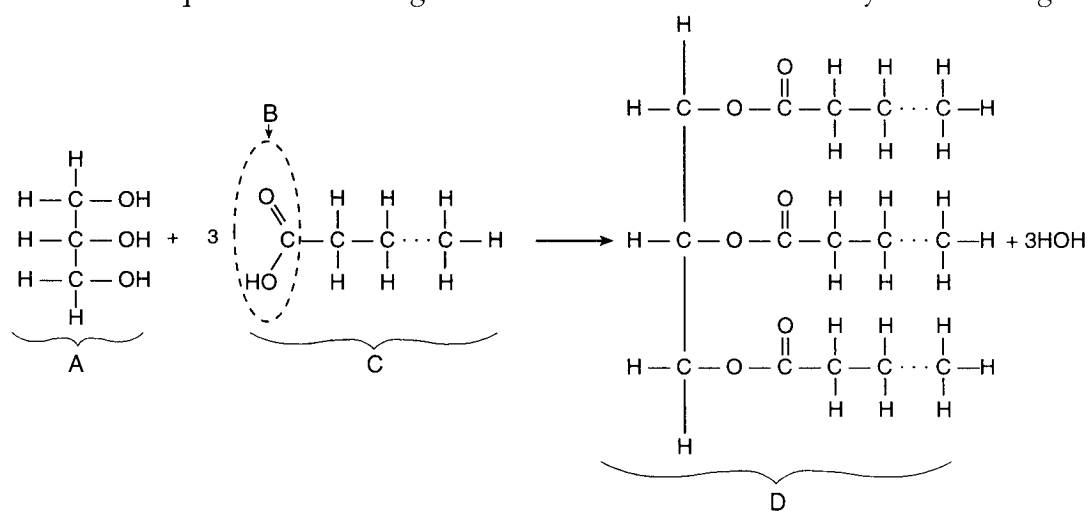
61 Letter B represents

- | | |
|-------------|------------|
| (1) 4 ADP | (3) 2 PGAL |
| (2) enzymes | (4) starch |

62 Letter C represents

- | | |
|--|-------------|
| (1) oxygen | (3) 4 ADP |
| (2) $2\text{C}_6\text{H}_{12}\text{O}_6$ | (4) alcohol |

Base your answers to questions 63 through 65 on the reaction below and on your knowledge of biology.



63 Which letter indicates a carboxyl group?

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

64 Which enzyme must be present for this reaction to take place?

- | | |
|--------------|------------|
| 1 a protease | 3 a lipase |
| 2 maltase | 4 sucrase |

65 This chemical reaction is known as

- 1 enzymatic hydrolysis
- 2 photolysis
- 3 dehydration synthesis
- 4 deamination

Base your answers to questions 66 through 68 on the table below and on your knowledge of biology.

Enzyme	Effective Temperature Range (°C)	Optimum pH
A	60–80	3
B	30–40	3.5
C	20–38	9
D	20–27	7

66 If enzyme C is functioning at 25°C and a pH of 7, under which conditions would the rate of enzyme action probably increase?

- 1 The temperature is decreased to 22°C and the pH is kept the same.
- 2 The temperature is increased to 30°C and the pH is increased to 8.
- 3 The temperature is kept the same and the pH is decreased to 6.
- 4 The temperature is increased to 44°C and the pH is kept the same.

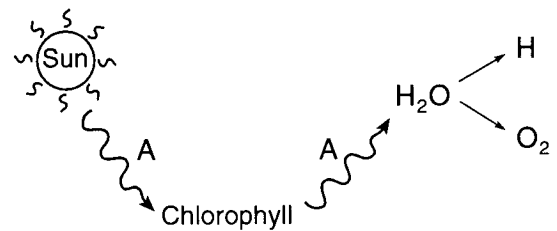
67 At what temperature would enzyme D most likely be denatured?

- | | |
|----------|----------|
| (1) 15°C | (3) 25°C |
| (2) 20°C | (4) 39°C |

68 Which enzyme would most likely be functional in bacteria living in a hot spring that is 35°C above normal human body temperature?

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

69 The diagram below represents some chemical events that take place in one type of autotrophic nutrition.



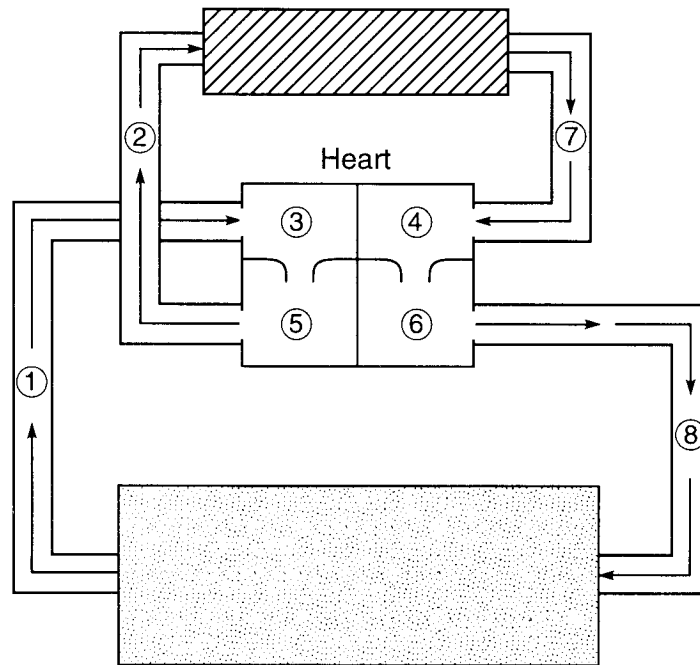
The arrows labeled A best represent

- | | |
|------------------|---------------|
| 1 carbon dioxide | 3 energy |
| 2 glucose | 4 lactic acid |

Group 2 — Human Physiology

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

Base your answers to questions 70 through 72 on the diagram below, which represents the pathway of blood throughout the body, and on your knowledge of biology.



70 Which structure carries oxygenated blood to the body?

- (1) 1
- (2) 2
- (3) 7
- (4) 8

71 Which sequence correctly represents blood flow known as pulmonary circulation?

- (1) 4 → 6 → 2 → 7
- (2) 5 → 2 → 7 → 4
- (3) 6 → 8 → 1 → 3
- (4) 3 → 5 → 8 → 1

72 Which structure represents the chamber of the heart that receives oxygenated blood directly from the lungs?

- (1) 5
- (2) 6
- (3) 3
- (4) 4

73 An allergic reaction characterized by the constriction of the bronchial tubes is known as

- 1 coronary thrombosis
- 2 arthritis
- 3 asthma
- 4 emphysema

74 A cerebral hemorrhage may result in

- 1 a stroke
- 2 gout
- 3 polio
- 4 meningitis

75 The contraction of the biceps and triceps muscles in the human arm is regulated by the

- 1 autonomic nervous system
- 2 pituitary gland
- 3 somatic nervous system
- 4 hypothalamus

BIOLOGY

Thursday, June 24, 1999 — 9:15 a.m. to 12:15 p.m., only

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

ANSWER PAPER

Student Sex: Male Female
 Teacher School

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

Part I (65 credits)

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

PART I CREDITS

Directions to Teacher:

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

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

No. right

Part II (20 credits)

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

**Group 1
Biochemistry**

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

**Group 3
Reproduction and
Development**

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

**Group 5
Ecology**

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

**Group 2
Human Physiology**

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

**Group 4
Modern Genetics**

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

Part III (15 credits)

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

Group 1

110

Data Table

Temperature (°C)	Heart Rate (beats/min)

111 – 112

Heart Rate (beats/min)

Temperature (°C)

113 1 2 3 4

114 1 2 3 4

Group 2

115 1 2 3 4

116 1 2 3 4

117 1 2 3 4

118 1 2 3 4

119 _____

Group 3

120 1 2 3 4

121 1 2 3 4

122 1 2 3 4

123 1 2 3 4

124 _____

Group 4

125 _____

126 1 2 3 4

127 1 2 3 4

128 1 2 3 4

129 1 2 3 4

Group 5

130 _____

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

76 In some regions of the world, children suffer from a protein deficiency known as kwashiorkor. This deficiency occurs when a child's diet is changed from high-protein breast milk to watery cereal. Even though the child is receiving calories, the child becomes sick and less active, and growth ceases. These symptoms are probably due to

- 1 too many nucleic acids in the diet
- 2 an overconsumption of complete protein foods
- 3 not enough carbohydrates in the diet
- 4 a lack of essential amino acids in the diet

Directions (77–78): For each phrase in questions 77 and 78, select the endocrine gland, chosen from the list below, that is best described by that phrase. Then record its number on the separate answer paper.

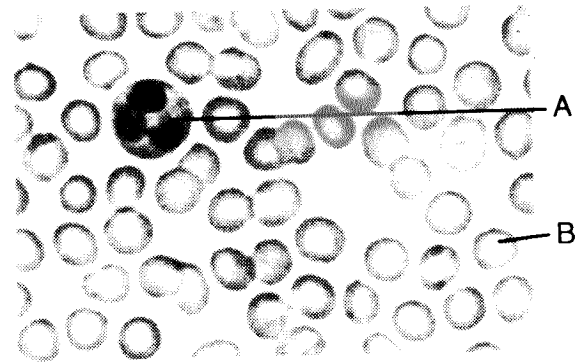
Endocrine Glands

- (1) Thyroid
- (2) Adrenal
- (3) Islets of Langerhans
- (4) Parathyroid

77 Secretes a hormone in times of emergency, accelerating metabolic activities

78 Requires a supply of iodine to synthesize its hormone

79 A photograph of a slide of human blood taken from a healthy individual is shown below.



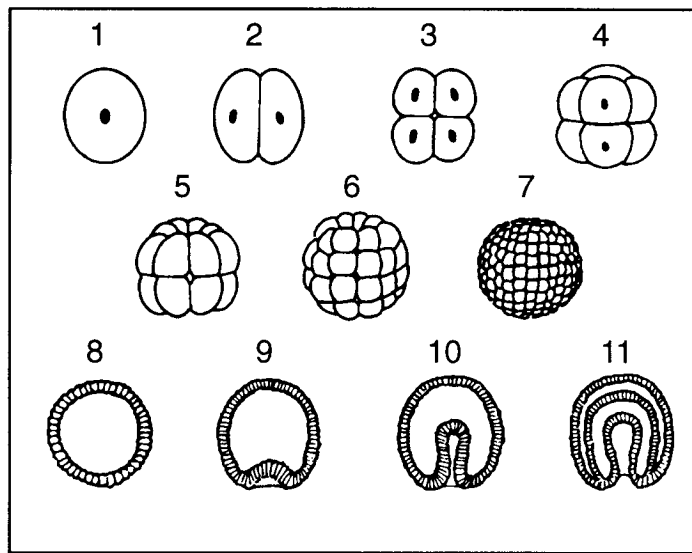
Which statement best describes the change that would be observed if the slide contained blood from an individual with anemia?

- 1 Cell type A would be fewer in number and larger in size.
- 2 Cell type B would be fewer in number and lighter in appearance.
- 3 Cell type B would be larger in size and greater in number.
- 4 Cell type A would be larger in size and darker in appearance.

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 diagrams below and on your knowledge of biology.



80 Which diagram shows the first appearance of the distinct layer of cells that will form the muscular, skeletal, and circulatory systems?

- (1) 11 (3) 6
 (2) 8 (4) 4

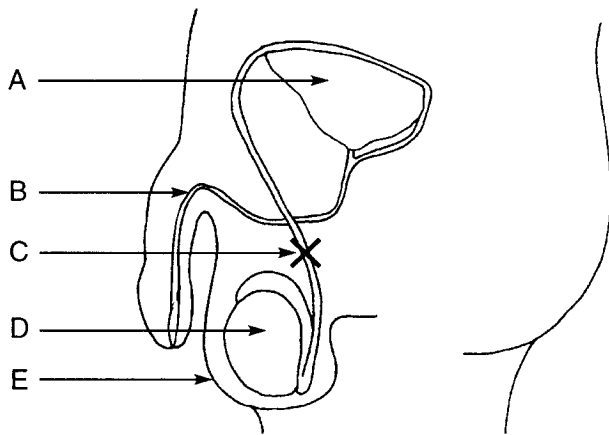
81 If stages 1 through 4 represent developmental stages of a human, where in the human female would these stages normally occur?

- 1 ovary 3 oviduct
 2 vagina 4 uterus

82 Which events must occur immediately before the sequence represented in the diagrams can take place?

- 1 gametogenesis and fertilization
 2 menstruation and menopause
 3 prenatal development and gestation
 4 placenta formation and metamorphosis

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



83 What would most likely happen if structure C was blocked at the X?

- 1 Sperm production would increase.
- 2 Sperm could not be transported to the outside of the body.
- 3 Urine could not be discharged from the urinary bladder.
- 4 Sex hormones would no longer be produced.

84 Which structure produces a hormone that is responsible for such characteristics as body hair, muscle development, and a deep voice?

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

85 Which structure is part of both the reproductive and excretory systems?

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

Base your answers to questions 86 and 87 on the organisms listed below and on your knowledge of biology.

Organisms

- (A) Fish
- (B) Amphibians
- (C) Reptiles
- (D) Birds
- (E) Mammals

86 In which organisms are the embryos *least* dependent on yolk for food?

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

87 Which organisms generally produce eggs that are fertilized externally and develop externally?

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

88 Which sequence represents the normal order of events that occur during the menstrual cycle?

- 1 menstruation → ovulation → corpus luteum → follicle stage
- 2 follicle stage → ovulation → corpus luteum → menstruation
- 3 ovulation → follicle stage → corpus luteum → menstruation
- 4 follicle stage → menstruation → corpus luteum → ovulation

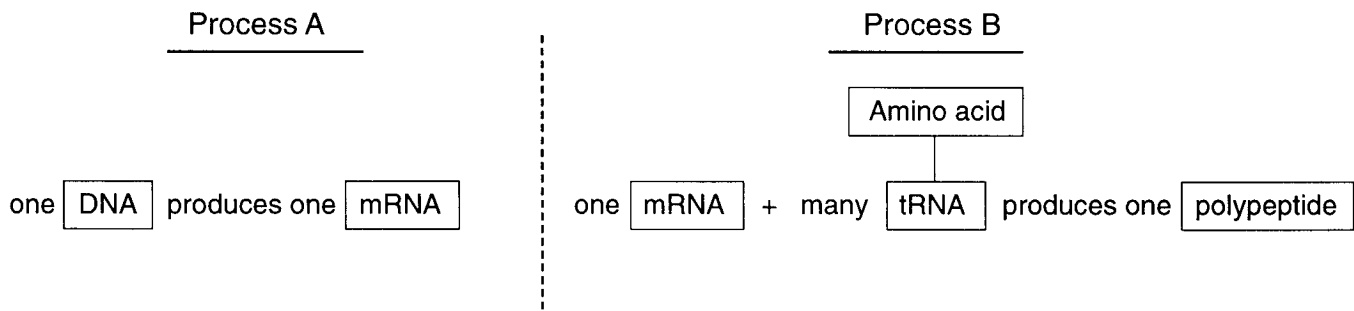
89 Substances can diffuse from the mother's blood into the fetal blood through the structure known as the

- | | |
|------------------|------------|
| 1 amnion | 3 yolk sac |
| 2 fallopian tube | 4 placenta |

Group 4 — Modern Genetics

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

Base your answers to questions 90 and 91 on the diagram below of two processes in the synthesis of proteins and on your knowledge of biology.



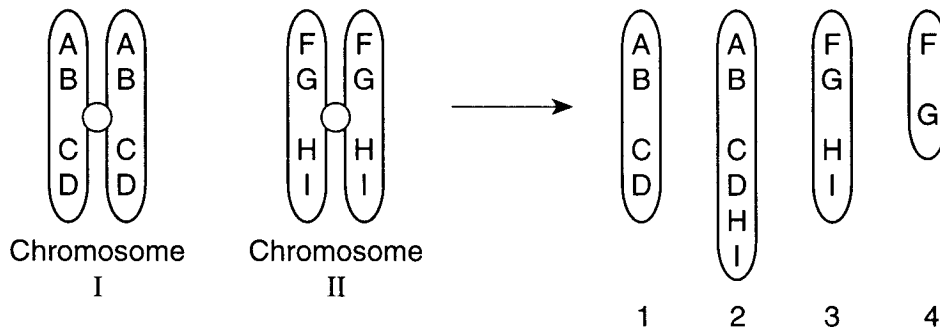
90 Process *B* involves the pairing of a codon with a triplet code on a transfer RNA molecule. A correct pairing would be

- (1) CAT and GTA (3) GUG and UGU
 (2) AAU and UUA (4) CAG and GUA

91 Process *A* occurs within the

- 1 mitochondrion 3 chloroplast
 2 ribosome 4 nucleus

92 The diagram below shows some chromosomal alterations.



Which chromosome represents an alteration known as a deletion?

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

Directions (93–94): For *each* phrase in questions 93 and 94, select the laboratory technique, *chosen from the list below*, that is most closely associated with that phrase. Then record its *number* on the separate answer paper.

Laboratory Techniques

- (1) Blood screening
- (2) Amniocentesis
- (3) Karyotyping
- (4) Urine analysis

93 Enlarging photographs of chromosomes from a fetal cell and arranging these chromosomes in homologous pairs

94 Removal and examination of a sample of fluid surrounding the fetus

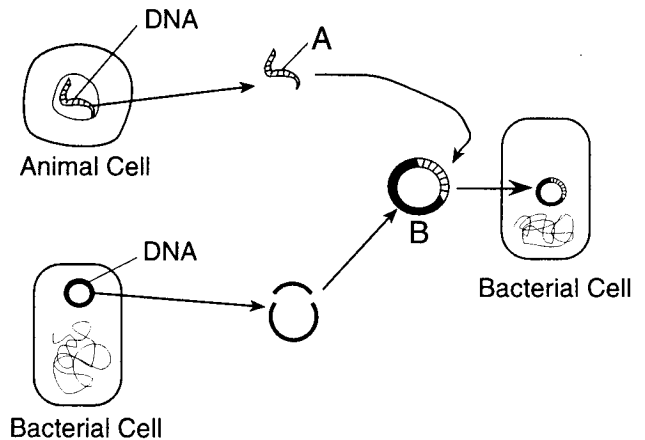
95 Which genetic disorder is characterized by a buildup of fatty tissue in the nervous system?

- | | |
|----------------------|-----------------|
| 1 phenylketonuria | 3 Down syndrome |
| 2 sickle-cell anemia | 4 Tay-Sachs |

96 The total of the heritable factors for the traits in the deer population of New York State is an example of a

- 1 gene pool
 - 2 phenotypic ratio
 - 3 diploid number
 - 4 chromosome number
-

Base your answers to questions 97 through 99 on the diagram below and on your knowledge of biology.



97 Structure A contains a

- 1 genetic code
- 2 single nucleotide, only
- 3 messenger RNA molecule
- 4 small polysaccharide

98 Structure B represents

- | | |
|----------------|-------------------|
| 1 a ribosome | 3 recombinant DNA |
| 2 transfer RNA | 4 a male gamete |

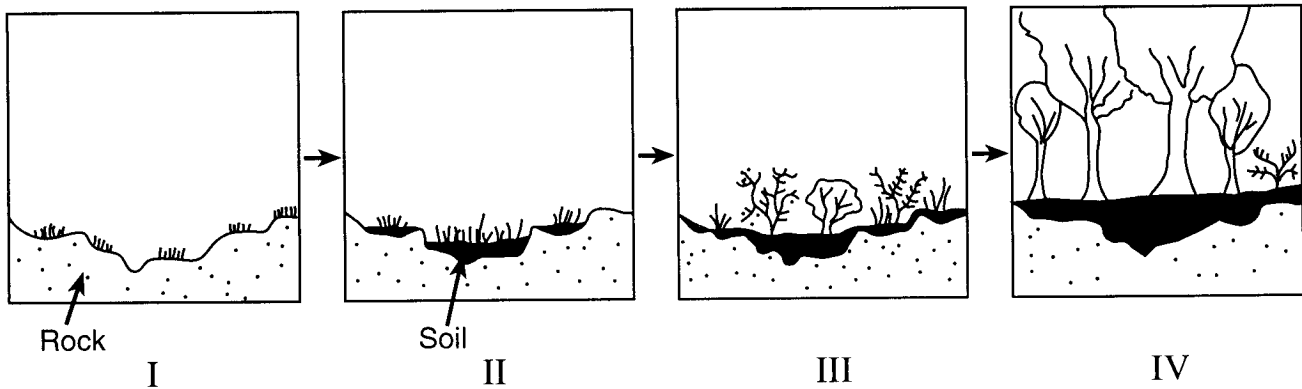
99 The technique illustrated in the diagram is known as

- 1 cloning
- 2 genetic engineering
- 3 protein synthesis
- 4 in vitro fertilization

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 diagrams below of four stages of a biological process and on your knowledge of biology.



100 What would most likely be the predominant life-form found in stage I?

- | | |
|-----------------|-------------------|
| 1 ferns | 3 mushrooms |
| 2 tracheophytes | 4 pioneer species |

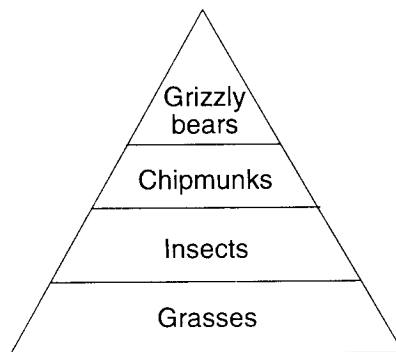
101 What is a major limiting biotic factor for animal succession in each stage?

- | | |
|-----------------|-----------------|
| 1 plant species | 3 soil minerals |
| 2 sunlight | 4 moisture |

102 Stage IV will persist until it is altered by

- 1 the growth in diameter of the trees
- 2 a major change in an abiotic factor
- 3 the reappearance of lichens and mosses
- 4 seasonal dieback of vegetation

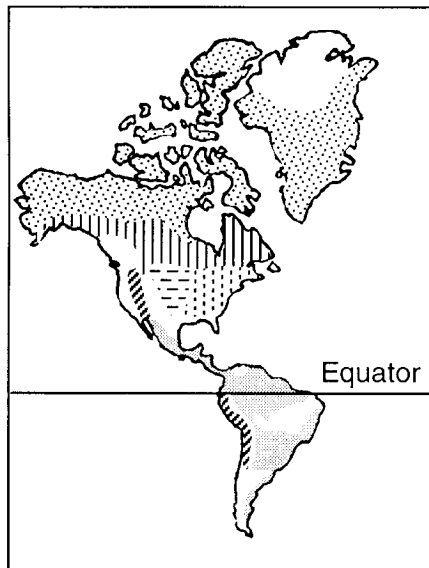
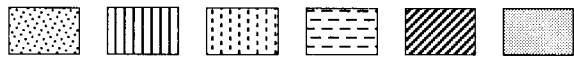
103 The pyramid below illustrates some feeding relationships in alpine meadows of Yellowstone National Park.




Which statement is best supported by the information shown in the pyramid?

- 1 Chipmunks and insects can occupy the same niche.
- 2 As the number of bears in this community increases, the number of chipmunks will increase.
- 3 Insects are classified as omnivores in alpine meadow communities.
- 4 Biomass decreases as energy is transferred from one level to another.

Base your answers to questions 104 through 106 on the map below, which shows the general location of some major biomes of Earth, and on your knowledge of biology. A different biome is represented by each of the following symbols:




104 Which climax flora would be a major part of the biome indicated by the symbol  ?

- | | |
|--------------------|-----------|
| 1 mosses | 3 grasses |
| 2 succulent plants | 4 lichens |

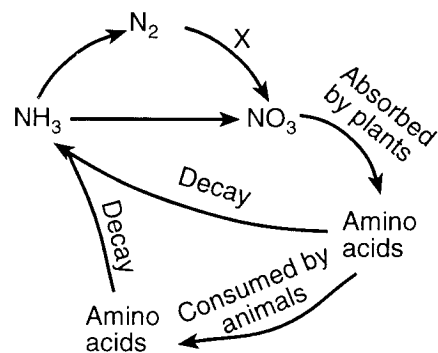
105 Which symbol indicates an area with coniferous trees; long, severe winters; and black bears?

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

106 What is one characteristic of the biome indicated by the symbol  ?

- 1 permanently frozen subsoil
- 2 extreme daily temperature fluctuations
- 3 drought-resistant shrubs
- 4 deciduous trees

Base your answers to questions 107 and 108 on the diagram below and on your knowledge of biology.



107 Which gas is released when the tissues of dead plants and animals are broken down by bacteria?

- | | |
|-------------------|-------------------|
| (1) NO_3 | (3) NH_3 |
| (2) N_2 | (4) O_2 |

108 Bacteria responsible for process X are known as

- 1 nitrogen-fixing bacteria
- 2 nitrifying bacteria
- 3 denitrifying bacteria
- 4 autotrophic bacteria

109 The American dogwood, a flowering tree of New York State's woodlands, has been attacked by a fungal disease specific to this tree species. Many dogwoods have died because fungicides have not proven effective in fighting the spread of this disease. Which term best describes the relationship between the dogwood trees and the fungus?

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

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.

A student performed a laboratory investigation to determine the effect of temperature on the heart rate of *Daphnia* (water flea). The following temperatures and heart rates were recorded:

20°C — 270 beats/min; 10°C — 150 beats/min;
15°C — 180 beats/min; 25°C — 300 beats/min;
5°C — 108 beats/min

- 110 Organize the data by filling in the data table *provided on your answer paper*. Complete both columns in the data table so that the temperature either increases or decreases from the top to the bottom of the 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)	Heart Rate (beats/min)

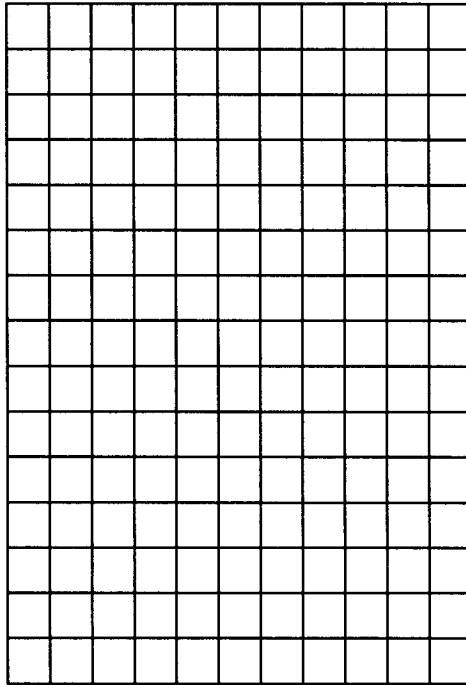
Directions (111–112): Using the information provided, construct a line graph on the grid *provided on your answer paper*, following the directions below. The grid on the next page is provided for practice purposes only. Be sure your final answer appears *on your answer paper*. You may use pen or pencil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

- 111 Mark an appropriate scale on each labeled axis.

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



Heart Rate (beats/min)



Temperature (°C)

113 During which temperature interval did the greatest change in heart rate occur?

- (1) 5–10°C (3) 15–20°C
(2) 10–15°C (4) 20–25°C
-

114 Which number indicates an acidic pH?

- (1) 14 (3) 3
(2) 12 (4) 7
-

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.

The Mystery of Deformed Frogs

Deformities, such as legs protruding from stomachs, no legs at all, eyes on backs, and suction cup fingers growing from sides, are turning up with alarming frequency in North American frogs. Clusters of deformed frogs have been found in California, Oregon, Colorado, Idaho, Mississippi, Montana, Ohio, Vermont, and Quebec.

Scientists in Montreal have been studying frogs in more than 100 ponds in the St. Lawrence River Valley for the past 4 years. Normally, less than 1% of frogs are deformed, but in ponds where pesticides are used on surrounding land, as many as 69% of the frogs were deformed. A molecular biologist from the University of California believes that the deformities may be linked to a new generation of chemicals that mimic growth hormones. The same kind of deformities found in the ponds have been replicated in laboratory experiments.

Some scientists have associated the deformities with a by-product of retinoid, which is found in acne medication and skin rejuvenation creams. Retinoids inside a growing animal can cause deformities. For this reason, pregnant women are warned not to use skin medicines that contain retinoids. Recent laboratory experiments have determined that a pesticide can mimic a retinoid.

A developmental biologist from Hartwick College in Oneonta, New York, questioned whether a chemical could be the culprit because there were no deformed fish or other animals found in the ponds where the deformed frogs were captured. He believes parasites are the cause. When examining a three-legged frog from Vermont, the biologist found tiny parasitic flatworms packed into the joint where a leg was missing. In a laboratory experiment, he demonstrated that the invasion of parasites in a tadpole caused the tadpole to sprout an extra leg as it developed. Scientists in Oregon have made similar observations.

115 Why are pregnant women advised not to use skin medicines containing retinoids?

- 1 Retinoid by-products may cause fetal deformities.
- 2 Retinoid by-products cause parasites to invade developing frogs.
- 3 Retinoid by-products mimic the effects of pesticides on fetal tissue.
- 4 Retinoid by-products reduce abnormalities in maternal tissue.

116 Some scientists argue that pesticides may *not* be the cause of the frog deformities because

- 1 pesticide use has decreased over the last 4 years
- 2 new pesticides are used in skin-care products
- 3 other animals in the ponds containing deformed frogs did not have abnormalities
- 4 laboratory experiments have determined that a pesticide can mimic retinoids

- 117 A possible reason for the absence of deformed fish in the ponds that contained deformed frogs is that
- 1 fish can swim away from chemicals introduced into the pond
 - 2 parasites that affect frogs usually do not affect fish
 - 3 fish cannot develop deformities
 - 4 frogs and fish are not found in the same habitat

118 Which inference can be made from the information in the passage?

- 1 Only a few isolated incidents of frog deformities have been observed.
- 2 If frog parasites are controlled, all frog deformities will stop.
- 3 Deformities in frogs are of little significance.
- 4 Factors that affect frogs may also affect other organisms.

-
- 119 Using one or more complete sentences, state what substance a student could use to test for the presence of starch in a food sample *and* describe the positive result of this test. You may use pen or pencil for your answer.
-

Group 3

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

120 Which sequence contains the correct order of steps for a student to follow to observe the nucleus of protozoa in a stained wet mount, using a compound light microscope?

	Begin by using the	Focus using the	Focus using the	Switch to the
(1)	low-power objective →	coarse adjustment →	fine adjustment →	high-power objective
(2)	low-power objective →	fine adjustment →	coarse adjustment →	high-power objective
(3)	high-power objective →	coarse adjustment →	fine adjustment →	low-power objective
(4)	high-power objective →	fine adjustment →	coarse adjustment →	low-power objective

121 A compound light microscope has a 10× ocular, a 10× low-power objective, and a 40× high-power objective. The diameter of the low-power field is 1,500 micrometers. Which information is *not* needed to calculate the diameter of the high-power field of this microscope?

- 1 diameter of the low-power field
- 2 magnification of the high-power objective
- 3 magnification of the low-power objective
- 4 magnification of the ocular lens

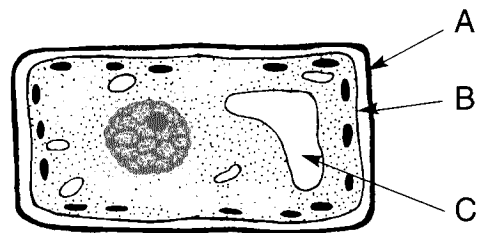
122 Which organelles would be most visible in a stained elodea leaf when viewed with the low-power objective of a compound light microscope?

- 1 endoplasmic reticula, chloroplasts, and nuclei
- 2 cell walls, nuclei, and ribosomes
- 3 chloroplasts, nuclei, and mitochondria
- 4 cell walls, chloroplasts, and nuclei

123 Which substance is used as a stain to make it easier to observe a wet mount of cheek cells with a compound light microscope?

- | | |
|-----------------------|-------------------|
| 1 Benedict's solution | 3 bromthymol blue |
| 2 methylene blue | 4 salt solution |

124 A plant cell is represented in the diagram below.



Select one of the lettered structures. Record the letter of the structure chosen in the space *provided on your answer paper* and, using one or more complete sentences, state the function of the structure. You may use pen or pencil for your answer.

Group 4

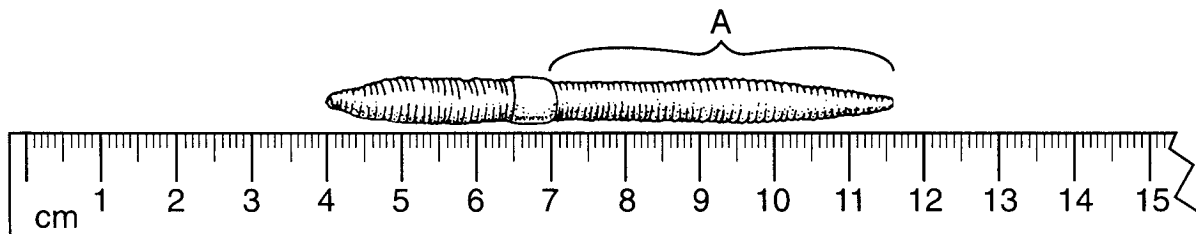
If you choose this group, be sure to answer questions 125–129.

125 The table below lists four groups of materials.

Group A	Group B	Group C	Group D
microscope	dissecting pan	hot plate	hydra culture
glass slide	dissecting pins	large beaker	depression slide
coverslip	hand lens	water	coverslip
water	razor blade	test tubes	microscope
dropper	scissors	test-tube rack	toothpick
pond water	earthworm	assorted food items	vinegar
		Benedict's solution	flashlight

Choose one of these groups. In the space *provided on your answer paper*, write the letter of the group chosen and, using one or more complete sentences, describe a laboratory activity for which that group of materials could be used. You may use pen or pencil for your answer.

126 A student measured an earthworm using a metric ruler, as shown in the diagram below.



What is the length of section A?

- (1) 7.6 cm
- (2) 11.6 cm
- (3) 46 mm
- (4) 23 mm

127 An investigation was designed to determine the effect of ultraviolet light on mold spore growth. Two groups of mold spores were grown under identical conditions, except one group was exposed only to ultraviolet light, while the other group was grown in total darkness. In this investigation, the group of mold spores grown without receiving any ultraviolet light is known as the

- 1 experimental variable
- 2 hypothesis
- 3 control
- 4 limiting factor

128 Which pair of structures can be observed *without* dissecting an earthworm?

- 1 mouth and pharynx
- 2 skin and ventral nerve cord
- 3 anus and aortic arches
- 4 setae and excretory pores

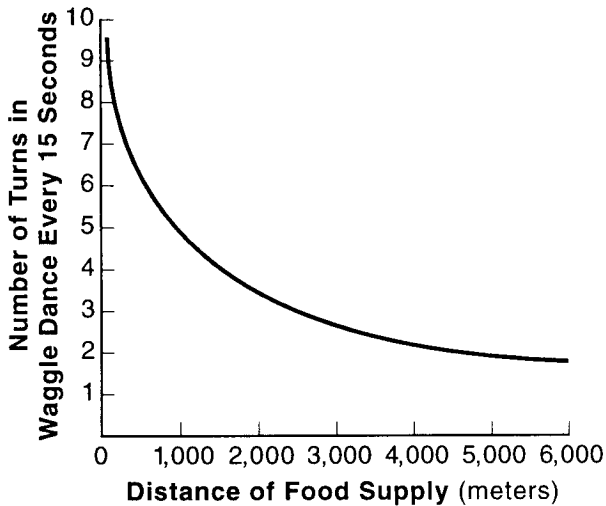
129 Antibiotic X has a unique characteristic in that it fluoresces (glows) when exposed to ultraviolet light. An investigator added antibiotic X to a dish containing a culture of cells. She exposed the cells to ultraviolet light and found that antibiotic X was highly concentrated within mitochondria. Which assumption could the investigator make regarding the results of this experiment?

- 1 Antibiotic X could be used to identify mitochondria in living cells.
- 2 Antibiotic X could be used to stain nuclei of living cells.
- 3 All fluorescent materials will be absorbed by mitochondria.
- 4 All antibiotics will be absorbed by mitochondria.

Group 5

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

- 130 Worker bees acting as scouts are able to communicate the distance of a food supply from the hive by performing a “waggle dance.” The graph below shows the relationship between the distance of a food supply from the hive and the number of turns in the waggle dance every 15 seconds.



Using one or more complete sentences, state the relationship between the distance of the food supply from the hive and the number of turns the bee performs in the waggle dance every 15 seconds. You may use pen or pencil for your answer.

- 131 Based on experimental results, a biologist in a laboratory reports a new discovery. If the experimental results are valid, biologists in other laboratories should be able to perform
- 1 an experiment with a different variable and obtain the same results
 - 2 the same experiment and obtain different results
 - 3 the same experiment and obtain the same results
 - 4 an experiment under different conditions and obtain the same results

- 132 As part of an investigation, 10 bean seedlings in one setup were grown in the dark, while 10 seedlings in another setup were grown in sunlight. All other growth conditions were kept the same in both setups. The seedlings grown in the dark were white with long, slender stems. These seedlings eventually died. The seedlings grown in the sunlight were green and healthy. Which hypothesis was most likely being tested in this investigation?

- 1 Plants grown in the dark cannot perform the process of respiration.
 - 2 Sunlight is necessary for the normal growth of bean plants.
 - 3 Light is necessary for the germination of bean seeds.
 - 4 Light is necessary for proper mineral absorption by plants.
- 133 Male reproductive cells from numerous lubber grasshoppers, lake trout, and field mice were examined and found to have a flagellum. A valid conclusion that can be made based on this observation is that
- 1 only lubber grasshoppers, lake trout, and field mice are likely to produce reproductive cells with a flagellum
 - 2 all organisms produce male reproductive cells with a flagellum
 - 3 only male organisms produce reproductive cells with a flagellum
 - 4 all male lubber grasshoppers, lake trout, and field mice most likely produce reproductive cells with a flagellum

- 134 Using one or more complete sentences, state one safety procedure that should be followed when an animal dissection is performed. You may use pen or pencil for your answer.