BIOLOGY–E TEST or BIOLOGY–M TEST

You MUST decide now whether you want to take a Biology Test with Ecological Emphasis (BIOLOGY-E) or Molecular Emphasis (BIOLOGY-M). The top portion of the section of the answer sheet that you will use in taking the Biology Test you have selected must be filled in exactly as shown in one of the illustrations below. Note carefully that you have to do all of the following on your answer sheet.

1. Print BIOLOGY-E or BIOLOGY-M on the line under the words "Subject Test (print)."

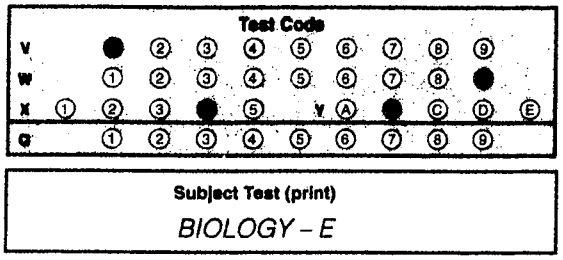
2. In the shaded box labeled "Test Code" fill in four circles as follows:

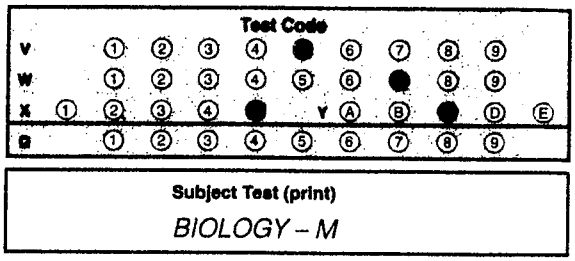
For BIOLOGY-E

— Fill in circle 1 in the row labeled V.
— Fill in circle 9 in the row labeled W.
— Fill in circle 4 in the row labeled X.
— Fill in circle B in the row labeled Y.

For BIOLOGY-M

— Fill in circle 5 in the row labeled V.
— Fill in circle 7 in the row labeled W.
— Fill in circle 5 in the row labeled X.
— Fill in circle C in the row labeled Y.





3. Please answer the questions below by filling in the appropriate circles in the row labeled Q on the answer sheet. The information you provide is for statistical purposes only and will not affect your score on the test.

Question I — How many semesters of biology have you taken in high school? (If you are taking biology this semester, count it as a full semester.) Fill in only one circle of circles 1-3.

- One semester or less — Fill in circle 1.
- Two semesters — Fill in circle 2.
- Three semesters or more — Fill in circle 3.

Question II — Which of the following best describes your biology course? Fill in only one circle of circles 4-6.

- General Biology — Fill in circle 4.
- Biology with emphasis on ecology — Fill in circle 5.
- Biology with emphasis on molecular biology — Fill in circle 6.

Question III — Which of the following best describes your background in algebra? (If you are taking an algebra course this semester, count it as a full semester.) Fill in only one circle of circles 7-8.

- One semester or less — Fill in circle 7.
- Two semesters or more — Fill in circle 8.

Question IV — Are you currently taking Advanced Placement Biology? If you are, fill in circle 9.

When the supervisor gives the signal, turn the page and begin the Biology Test. There are 100 numbered circles on the answer sheet. There are 60 questions in the core Biology Test, 20 questions in the Biology-E section, and 20 questions in the Biology-M section. Therefore use ONLY circles 1-80 (for Biology-E) OR circles 1-60 plus 81-100 (for Biology-M) for recording your answers.

BIOLOGY E/M TEST

FOR BOTH BIOLOGY-E AND BIOLOGY-M, ANSWER QUESTIONS 1-60

)irections: Each set of lettered choices below refers to the numbered questions or statements immediately following . Select the one lettered choice that best answers each question or best fits each statement and then fill in the corre-ponding circle on the answer sheet. A choice may be used once, more than once, or not at all in each set.

)uestions 1-4 refer to the following plant cell ypes.

(A) Tracheids and vessel elements
(B) Guard cells
(C) Parenchyma cells
(D) Sieve tube members and companion cells
(E) Sclerenchyma cells

1. Chains of these nonliving cells form continuous tubes for the transport of water in vascular plants.

2. These cells take up potassium ions and water when sunlight and low concentrations of carbon dioxide are present, which causes them to become rigid.

3. These versatile cells serve as storage sites for sugars and starches in stems and roots.

4. These cells form a living tissue which transports sugar from one part of a vascular plant to another.

Questions 5-6 refer to the following.

(A) 2
(B) 4
(C) 16
(D) 25
(E) 50

5. The expected percentage of offspring with the recessive phenotype from a cross between two individuals heterozygous for a particular trait

6. The number of different phenotypes possible for the progeny of the cross $AaBb \times AaBb$, where A and B exhibit simple dominance

Questions 7-10

(A) Monera
(B) Protista
(C) Fungi
(D) Plantae
(E) Animalia

7. Contains all the protozoa and most of the algae

8. Contains multicellular heterotrophic organisms that reproduce asexually by spores

9. Contains organisms without membrane-bound organelles such as nuclei

10. Contains autotrophic organisms with cells that are organized into tissues and organs

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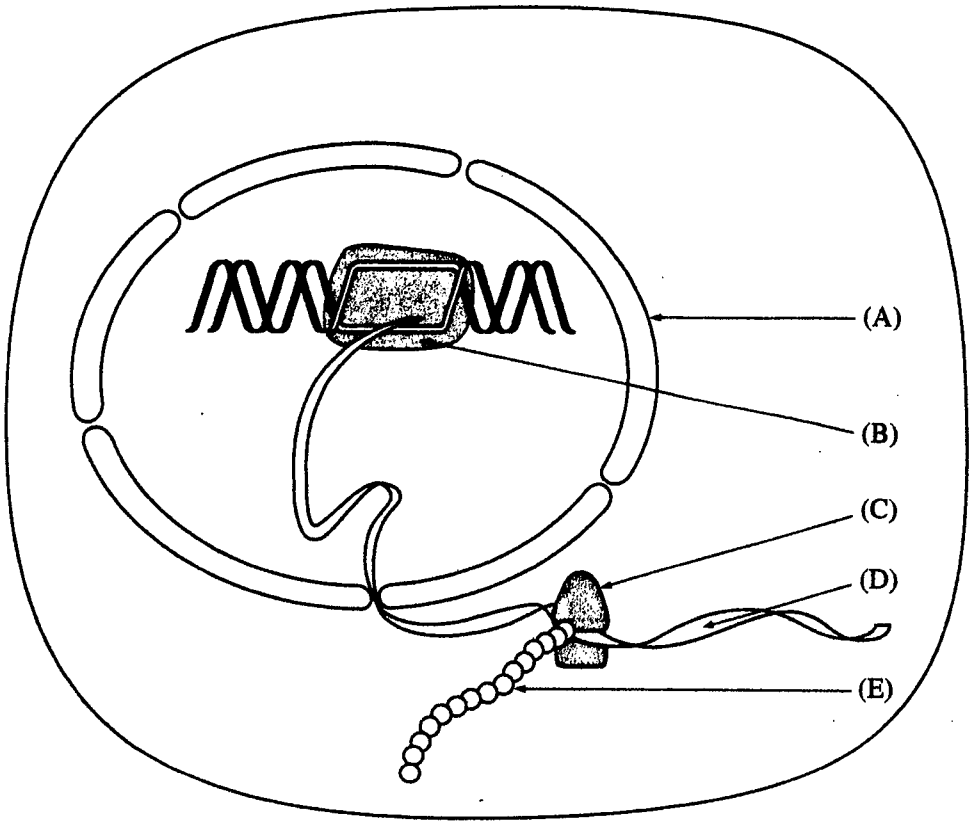
Questions 11-14 refer to the following illustration of protein synthesis in a mammalian cell.



11. A strand of mRNA being translated

12. A polypeptide being synthesized

13. A barrier to diffusion of large proteins from nucleus to cytoplasm

14. A structure that contains a lipid bilayer

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Questions 15-17

(A) Insulin
(B) Growth hormone
(C) Progesterone
(D) Thyroxin
(E) Secretin

15. It is secreted by the pituitary gland.

16. It directly controls metabolic rate.

17. Its concentration in the blood rises when the corpus luteum develops.

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Some questions pertain to a set that refers to a laboratory or experimental situation. For each question, select the one choice that is the best answer to the question and then fill in the corresponding circle on the answer sheet.

18. The ribosomes of a cell are of primary importance for

    (A) DNA replication
    (B) transcription
    (C) translation
    (D) translocation
    (E) repression

19. If a couple has two boys and one girl, what is the probability that the next child born to this couple will be a girl?

    (A) $\frac{1}{4}$
    (B) $\frac{1}{3}$
    (C) $\frac{1}{2}$
    (D) $\frac{2}{3}$
    (E) $\frac{3}{4}$

20. Eggs fertilized by two sperm instead of one sometimes form a mitotic spindle with three poles. After mitosis the daughter cells will probably

    (A) be indistinguishable from normal cells
    (B) eliminate the chromosomes contributed by the second sperm
    (C) eliminate the chromosomes contributed by the egg
    (D) display an abnormal number of chromosomes
    (E) stop protein synthesis immediately

21. In higher plant cells, a pigment important in the manufacture of carbohydrates from CO_2 and H_2O is contained in the

    (A) nucleus
    (B) vacuole
    (C) cytoplasm
    (D) chloroplast
    (E) centrosome

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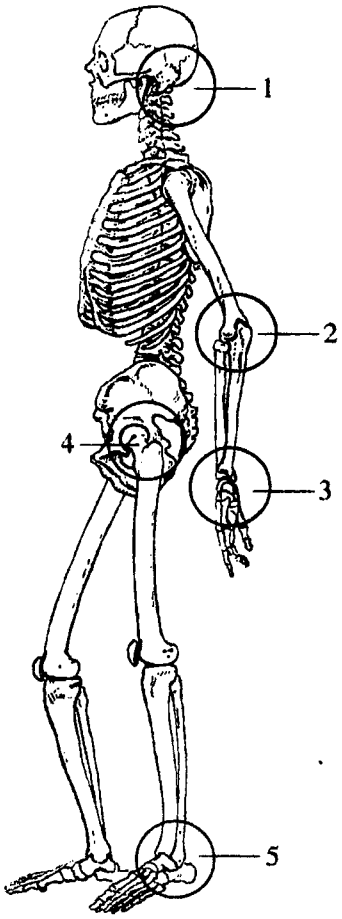


22. In the diagram of the human skeleton above, which of the following is a ball-and-socket joint?

(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

23. Which of the following statements is true for red blood cells that have been added to a flask of saturated NaCl solution?

(A) The cells will undergo mitosis.
(B) The cells will increase in volume.
(C) The cells will lose water.
(D) The cells are hypertonic relative to the surrounding medium.
(E) The concentration of NaCl is lower outside the cells than inside.

24. Today's worldwide human population can best be described as

(A) oscillating
(B) declining
(C) fluctuating near equilibrium
(D) growing arithmetically
(E) growing exponentially

25. The base of the food web of the open ocean is provided by

(A) phytoplankton
(B) zooplankton
(C) kelp
(D) fish
(E) whales

26. Nitrogen fixation is the conversion of atmospheric nitrogen into

(A) ammonia
(B) protein
(C) urea
(D) carbon dioxide
(E) DNA

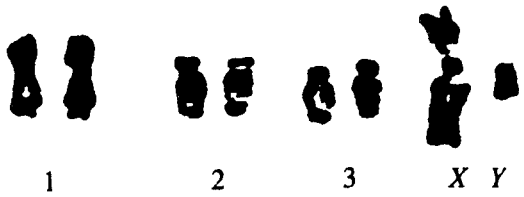
27. In the fruit fly, the allele for normal wings (*W*) is dominant over the allele for vestigial wings (*w*). A cross of two normal-winged flies produced 76 normal-winged and 23 vestigial-winged offspring. It can be concluded that the genotypes of the two parent flies were which of the following?

(A) *WW* and *ww*
(B) *WW* and *Ww*
(C) *Ww* and *ww*
(D) *Ww* and *Ww*
(E) *WW* and *WW*

28. Factors that have been known to result in the elimination of a species in a particular area include which of the following?

I. Use of insecticides
II. Hunting of the species' prey
III. Habitat destruction

(A) I only
(B) II only
(C) I and III only
(D) II and III only
(E) I, II, and III



29. According to the partial karyotype of a mammal shown above, which of the following must be true?

(A) The organism has a single gene defect.
(B) The organism is a male.
(C) The organism is a homozygote.
(D) The organism is a human.
(E) The alleles on both chromosomes labeled 3 are identical.

30. An organism is examined and is found to be multicellular and heterotrophic and to have cell walls made of a substance other than cellulose. The organism belongs to which of the following kingdoms?

(A) Monera
(B) Protista
(C) Fungi
(D) Plantae
(E) Animalia

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31. Which of the following statements is correct?

(A) Heritable variation allows for evolution.
(B) Adaptive radiation allows for mutation.
(C) Crossing-over allows for mitosis.
(D) Translocation allows for DNA replication.
(E) Cellular differentiation allows for meiosis.

32. Behavior that remains unaffected by environmental changes is most likely

(A) territorial
(B) learned
(C) innate
(D) stereotyped
(E) conditioned

33. A man who has hemophilia and a woman who does not have hemophilia have a daughter who has hemophilia. Hemophilia is a recessive condition, and the gene is located on the X chromosome. Which of the following can be concluded?

(A) The mother is a carrier for hemophilia.
(B) Hemophilia is not a sex-linked trait.
(C) Crossing-over has occurred.
(D) All subsequent daughters of this couple will have hemophilia.
(E) All sons of this couple will have hemophilia.

34. All of the following are measures useful in describing a given population's growth rate EXCEPT

(A) fertility
(B) mortality
(C) survivorship
(D) age structure
(E) habitat

35. Which of the following is LEAST consistent with the fossil record?

(A) Bony fish evolved from amphibians.
(B) Mammals evolved from reptiles.
(C) Birds evolved from reptiles.
(D) Reptiles evolved from amphibians.
(E) Cartilaginous fish evolved from jawless fish.

36. Which of the following is NOT true of enzymes?

(A) Enzyme activity is affected by changes in temperature.
(B) Enzymes change the rate at which biochemical reactions proceed.
(C) Enzyme activity is affected by large shifts in pH.
(D) Enzymes often require the presence of cofactors or coenzymes to become active.
(E) Enzymes are assembled from vitamin subunits.

37. The gene for a particular trait that is passed only from fathers to sons is most likely

(A) autosomal recessive
(B) autosomal dominant
(C) codominant
(D) *Y*-linked
(E) *X*-linked

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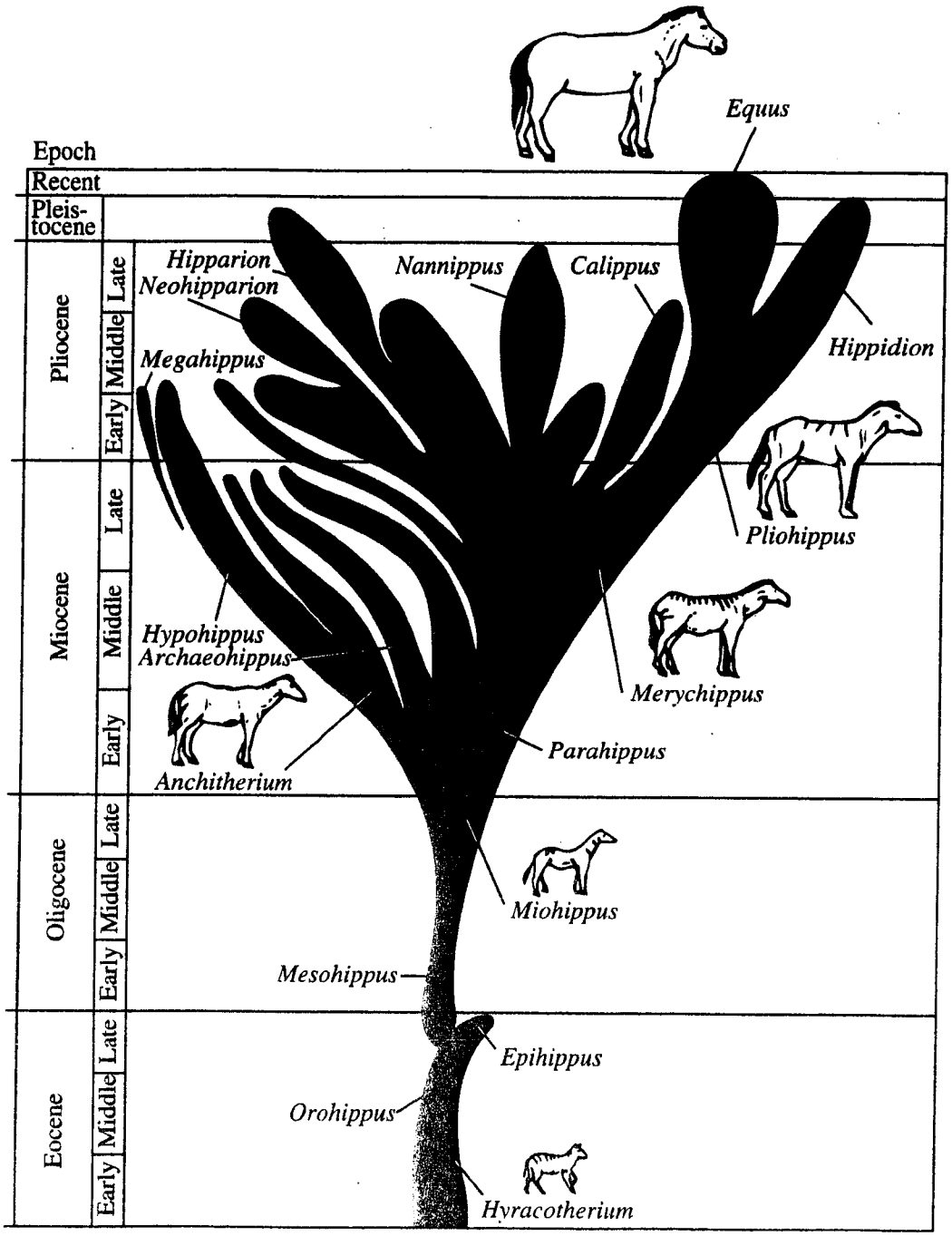

38. The diagram above illustrates a proposed phylogeny for horses. Which of the following genera is currently represented by live animals?

(A) *Epihippus*
(B) *Equus*
(C) *Hippidion*
(D) *Hyracotherium*
(E) *Nannippus*

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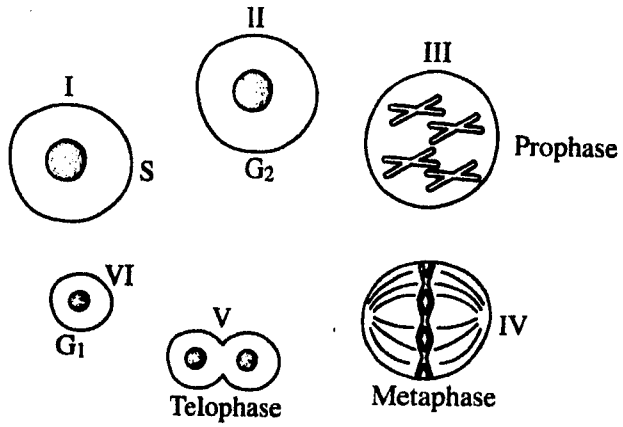
9. Which of the following organelles in human sperm provides the energy needed by the sperm?

(A) Flagellum
(B) Mitochondrion
(C) Y chromosome
(D) Centriole
(E) Nucleus

). Which of the following organs secretes the hormone responsible for the "fight-or-flight" reaction in mammals?

(A) Liver
(B) Kidney
(C) Pancreas
(D) Cowper's gland
(E) Adrenal gland



41. Most replication of DNA takes place during which of the following stages of the cell cycle?

(A) I
(B) II and III
(C) IV only
(D) IV and V
(E) VI

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42. Which of the following is a biotic factor that can make a major contribution to the regulation of a population in a given community?

(A) The annual pattern of rainfall
(B) The average ratio of O_2 to CO_2
(C) The annual pattern of daily temperature ranges
(D) The rate of weathering of rocks into soil
(E) The number of predators and competitors

43. Characteristics of adult echinoderms such as sea stars (starfish) include which of the following?

I. Tube feet
II. Bilateral symmetry
III. Water vascular system

(A) I only
(B) II only
(C) I and III only
(D) II and III only
(E) I, II, and III

44. If in an adult organism the genes *A* and *B* occur on one chromosome and their alleles *a* and *b* occur on its homologue, which of the following explains a combination of *Ab* or *aB* occurring in the gametes?

(A) Sex-linkage
(B) Lack of dominance
(C) Nondisjunction
(D) Crossing-over
(E) Blending

45. Which of the following is NOT a major function of the mammalian kidney?

(A) Elimination of urea and other nitrogenous wastes
(B) Maintenance of water balance
(C) Manufacture of antibodies
(D) Regulation of salt excretion
(E) Formation of urine from glomerular filtrate

46. An ecologically sound reason for conserving tropical rain forests is that they

(A) supply most of the oxygen that humans breathe
(B) occupy four-fifths of Earth's surface
(C) are the major producers of atmospheric nitrogen
(D) are crucial to migratory ungulates like bison and wildebeest
(E) are an important reservoir of biodiversity

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Questions 47-48

A population study of plants was done in an abandoned field. Each year for 3 years the vegetation was sampled. The chart below indicates the results of the study.

Year	Number of Plants per Acre				
	Sandspur	Ragweed	Timothy Grass	Goldenrod	Wire Grass
1	3,800	4,900	600	0	412
2	1,500	2,209	1,185	75	796
3	752	180	2,234	790	1,643

47. According to the data, which of the following are initially most successful in the succession taking place in the field described above?

(A) Sandspur and ragweed
(B) Sandspur and timothy grass
(C) Ragweed and timothy grass
(D) Ragweed and wire grass
(E) Sandspur and goldenrod

48. The data above suggest that

(A) fires cause the changes in the populations
(B) floods cause the changes in the populations
(C) the plants in the population have similar life spans
(D) plant populations are replacing one another
(E) the reproductive capacity of plants changes with time

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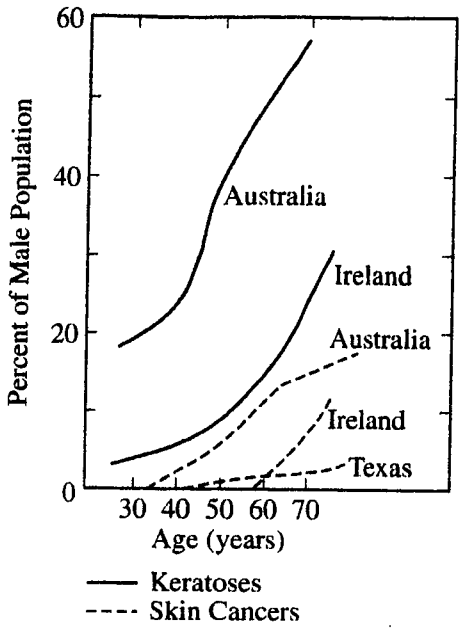
Questions 49-51

The figure below represents the increase in prevalence of both keratoses (thickened pigmented patches on the skin) and skin cancers in males of Irish descent in several geographic areas.



49. For which of the following groups can 20 percent of the male population be expected to have the indicated condition?

(A) Skin cancers in Australia at age 50
(B) Keratoses in Australia at age 30
(C) Keratoses in Australia at age 70
(D) Keratoses in Ireland at age 40
(E) Keratoses in Ireland at age 80

50. Which of the following can be inferred from these data?

(A) Skin cancers develop from keratoses.
(B) Keratoses develop from skin cancers.
(C) The majority of males with keratoses also have skin cancer.
(D) The environment in Australia is more likely to cause keratoses than is the environment in Ireland.
(E) The intensity of sunlight is the primary factor causing the development of skin cancers.

51. If the study were conducted as a function of the age of the female population in the same geographic areas, which of the following results would be most likely?

(A) The data would show a higher percentage of females with the diseases at all ages.
(B) The data would show a lower incidence of the diseases, because females have higher levels of estrogen.
(C) The data would be the same as for males in Australia and Ireland, but no predictions can be made for Texas.
(D) The data would be the same as for males with regard to keratoses but not for skin cancers.
(E) No accurate predictions can be made from the data because the sample populations would be different.

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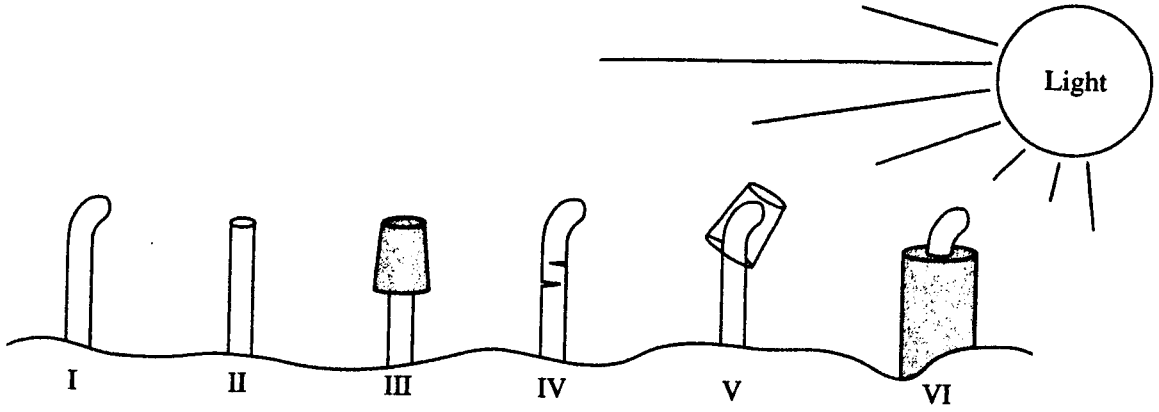
Questions 52-55

Charles Darwin and his son Francis performed a series of experiments on phototropism (growth toward light) the coleoptile (the cap that covers the first leaves of new seedlings of grass). The treatments they used are descrit below.



	Treatment	Growth Toward Light
I	Coleoptile untreated.	Allowed
II	Tip of coleoptile cut off.	Prevented
III	Opaque cap placed over coleoptile tip.	Prevented
IV	Coleoptile cut halfway through.	Allowed
V	Transparent cap placed over coleoptile tip.	Allowed
VI	Opaque sleeve placed over base of coleoptile.	Allowed

52. Comparison of treatments I and II shows which of the following?

(A) Growth is promoted by cutting off the tip.
(B) The tip is the site of sensing light.
(C) The tip is the site of auxin synthesis.
(D) The tip is necessary for the response to light.
(E) There is a range of response to a single treatment.

53. The fact that the effect of cutting off the tip (treatment II) is <u>not</u> simply due to wounding of the plant is demonstrated by comparison of whic of the following treatments?

(A) IV and V
(B) I, II, and III
(C) I, II, and IV
(D) II, III, and IV
(E) IV, V, and VI

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54. Comparison of treatments III, V, and VI shows that

(A) the tip plays a role in sensing the light
(B) the base plays a role in sensing the light
(C) confinement of the tip inhibits the response to light
(D) confinement of the base facilitates the response to light
(E) confinement reverses the response to light

55. To test the hypothesis that the response to light involves differential cell elongation, an experimenter could

(A) measure the distance between marks made on the seedling after it has bent
(B) count the number of cells visible in a cross section of the coleoptile
(C) compare the length of cells on the sides of the stem toward and away from the light
(D) determine whether mitosis is affected by light
(E) repeat the experiment using light of a different wavelength

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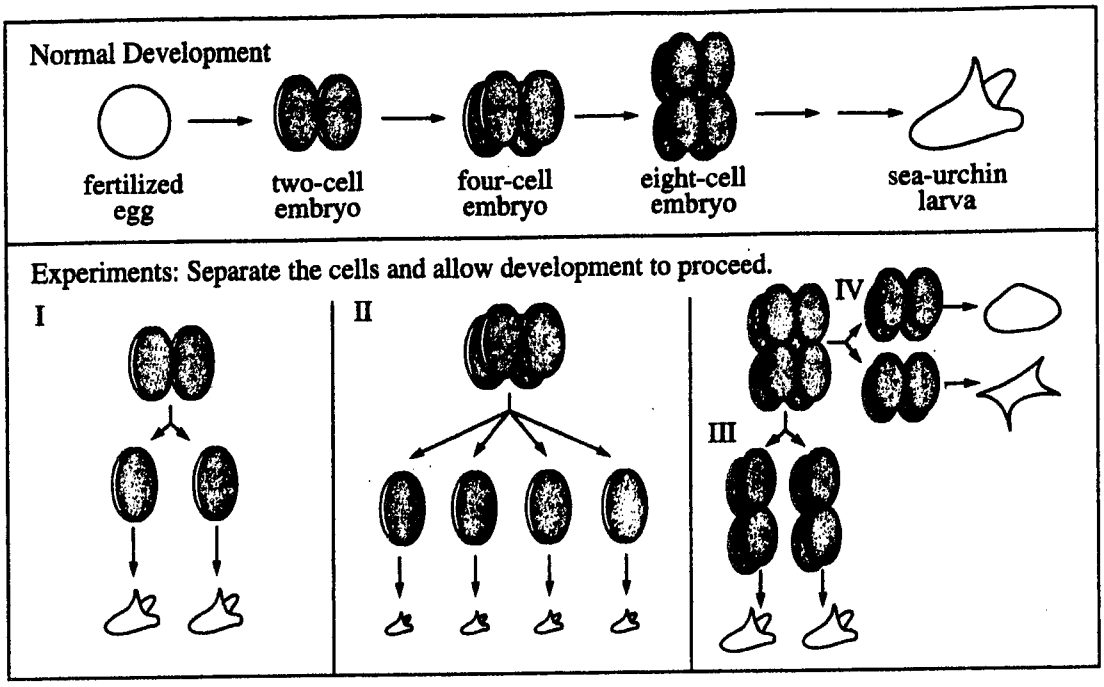
Questions 56-60

During normal development of the sea urchin, the egg divides once to give two cells. Each of these cells divides again. The cells continue to divide and, eventually, a sea-urchin larva is formed. It is possible to separate the cells of a young sea-urchin embryo and allow them to develop independently. The results of several such experiments are shown below.



56. Experiment I suggests that

(A) sea urchins would be better adapted if they had smaller eggs
(B) embryo cells are committed to different developmental fates
(C) different cells of an embryo can have equal potential for development
(D) a particular cell of an embryo always develops into the same structure
(E) cell division ensures that both cells will develop identically

57. Experiments I and II suggest that

(A) sea-urchin embryos often grow to full-size adults
(B) larva size is determined by the amount of material in the embryo
(C) development must always occur the same way in every embryo
(D) embryo cells do not interact with each other
(E) natural selection favors the formation of small larvae

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Experiments III and IV together suggest that

(A) there is a difference between separating cells along the vertical axis and the horizontal axis of an eight-cell embryo
(B) embryo cells cannot be separated without damaging development
(C) material at the top of the embryo is the same as material at the bottom
(D) cells divide correctly only when they are vertical
(E) embryo cells do not differ until gastrulation

59. The different results in experiments III and IV probably are caused by

(A) failure of mitosis to occur normally at the third cell division
(B) loss of chromosomes by the top four cells
(C) fertilization of the top and bottom of the egg by two different sperm
(D) different genes being expressed in the top four cells than in the bottom four cells
(E) some genes in the left half of the embryo that are different from those in the right half of the embryo

60. Which of the following questions is NOT addressed by this series of experiments?

(A) When do the cells of an embryo become different from each other?
(B) Can cells of an embryo survive when separated from each other?
(C) Can smaller larvae be produced by experimental manipulation?
(D) When are components in the fertilized egg activated?
(E) Can the cells of an embryo be made to develop abnormally?

If you are taking the Biology-E test, continue with questions 61-80.
If you are taking the Biology-M test, go to question 81 now.

BIOLOGY-E TEST

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Some questions pertain to a set that refers to a laboratory or experimental situation. For each question, select the one choice that is the best answer to the question and then fill in the corresponding circle on the answer sheet.

61. Stream and river ecosystems differ from other aquatic ecosystems because streams and rivers

    (A) move continuously in one direction and have a nutrient content that is dependent on location
    (B) support a greater diversity of aquatic plants
    (C) have highly variable salinity
    (D) include the greatest biodiversity of all ecosystems because of the fluctuating water levels
    (E) support the largest stationary plankton communities

62. A trophic level within an ecosystem is best characterized by the

    (A) size of food eaten at that level
    (B) nutrient source of the organisms in each level
    (C) stages in ecological succession
    (D) habitats of the organisms within that level
    (E) elevation above sea level

63. According to most scientific theories of the origin of life, the first organisms were

    (A) eukaryotic
    (B) parasitic
    (C) symbiotic
    (D) anaerobic
    (E) pathogenic

64. The global cycles of nitrogen and phosphorus differ in that

    (A) nitrogen is recycled whereas phosphorus is not
    (B) animals get most of their nitrogen from the water they drink whereas they get their phosphorus from the food they eat
    (C) nitrogen occurs primarily in deep sediments whereas phosphorus occurs primarily in the atmosphere
    (D) nitrogen is lost to the oceans whereas phosphorus is not
    (E) nitrogen has a gaseous phase whereas phosphorus does not

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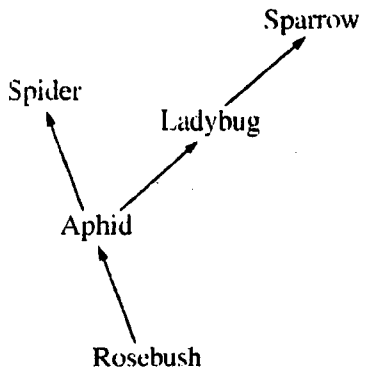

65. In the food web shown above, in which the arrows indicate the direction of energy flow, the ladybug is considered to be a

(A) herbivore
(B) primary consumer
(C) decomposer
(D) producer
(E) carnivore

66. A stream is free of pollutants within a few miles downstream of a point at which a small amount of sewage is being dumped into it. This is most likely the result of

(A) succession
(B) biological magnification
(C) evaporation
(D) photosynthesis
(E) decomposition

67. The term "adaptive radiation" refers to the

(A) ability of one species to adapt to only one niche
(B) ability of a species to adapt itself to rapidly changing conditions
(C) evolution from a single ancestral species into several species adapted to various environments
(D) ability of a species to adjust its temperature by radiating heat
(E) advantages of radial symmetry to a stationary species

68. Which of the following does NOT refer primarily to a relationship between members of different species?

(A) Mutualism
(B) Hibernation
(C) Parasitism
(D) Commensalism
(E) Predation

69. Plant seeds can be dispersed by which of the following?

I. Wind
II. Water
III. Birds

(A) I only
(B) III only
(C) I and II only
(D) I and III only
(E) I, II, and III

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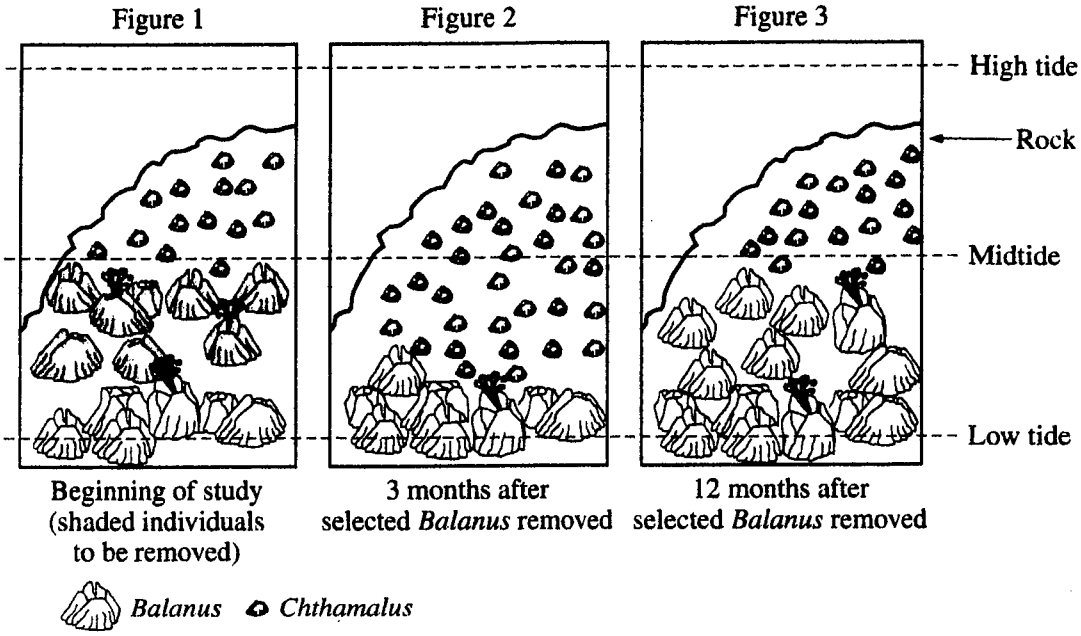
Questions 70-72

Two types of barnacles, *Chthamalus* and *Balanus*, grow on rocks along the North Atlantic coastline. Both grow on rock surfaces exposed at low tide and covered at high tide. At the beginning of a study of competition between these barnacles, a researcher removed selected *Balanus* from a region and followed the changes in distribution of both species for 12 months. The distribution of *Chthamalus* and *Balanus* are shown in Figures 1, 2, and 3.



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10. Since both species of barnacles have free-swimming larvae that settle on hard surfaces, the change in the distribution of *Chthamalus* observed 3 months after removal of the larger *Balanus* individuals could best be explained by which of the following?

(A) *Balanus* feeds on *Chthamalus* larvae.
(B) *Balanus* does not reproduce as quickly as *Chthamalus*.
(C) *Balanus* has less tolerance for wet conditions.
(D) *Balanus* adults are mobile.
(E) *Balanus* is less susceptible to predators.

11. The distribution of the two species at 3 and 12 months suggests all of the following EXCEPT:

(A) *Balanus* sometimes dominates over the smaller *Chthamalus*.
(B) *Chthamalus* can tolerate more drying than *Balanus*.
(C) *Balanus* adults are swept away more often than *Chthamalus*.
(D) *Balanus* and *Chthamalus* larvae can settle in the same area.
(E) *Balanus* is larger and thus needs more feeding time in the water.

72. Based on this study, on rocks with tops below the midtide line, it can be predicted that

(A) more of the rock surface would be covered by *Chthamalus*
(B) the two barnacle populations would be equal
(C) there would be few, if any, *Balanus*
(D) there would be few, if any, *Chthamalus*
(E) *Balanus* individuals would become smaller

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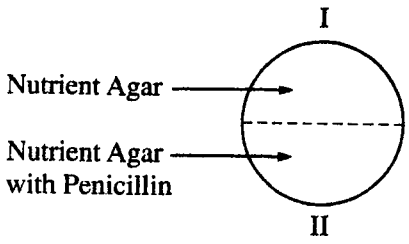
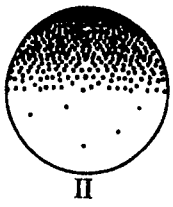
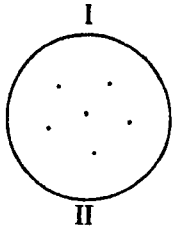
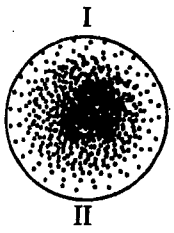
Questions 73-75 refer to the following experiment in which an agar petri dish was prepared as shown below. Using aseptic techniques, an experimenter spread *E. coli* bacteria on the agar uniformly throughout the dish. The dish was then incubated at 37°C for 24 hours.

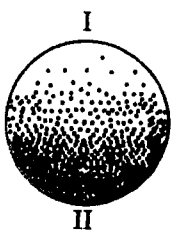


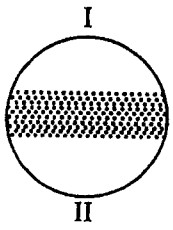
73. Which of the following distributions of bacterial colonies is most likely to be observed on completion of the experiment? (Dots represent bacterial colonies.)

(A)


(B)


(C)


(D)


(E)


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74. The cells that survived exposure to penicillin were most likely able to do so because they

(A) mutated as a result of the exposure
(B) had a more rapid metabolism than the other cells
(C) lacked cell walls
(D) already possessed penicillin resistance
(E) formed spores

75. In the experiment, penicillin causes a stress that, in an ecosystem, would promote

(A) natural selection
(B) Lamarckian evolution
(C) competition
(D) mutation
(E) parasitism

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Questions 76-80

A scientist studied a field that had been burned in a brushfire ten years before. She identified seven different species and produced the table below.

Scientific Name	Gross Form	Microscopic Form	Stem Form	Color	Reproduction
Platismartia glauca	sheetlike	eukaryotic and prokaryotic filaments	not applicable	green on top white below	none evident
Funaria americana	cushionlike	eukaryotic multicellular	not applicable	green throughout	spore-producing structures on stalks
Dryopteris spinulosa	roots, underground stems, compound leaves	eukaryotic multicellular	fleshy	green leaves, white stem and roots	spores on underside of leaves
Picea rubens	roots, stems, needlelike leaves	eukaryotic multicellular	erect, woody	green leaves, brown stem and roots	cones
Smilax herbacea	roots, vine, broad leaves	eukaryotic multicellular	erect, herbaceous	green leaves and stem, white roots	flowers
Smilax rotundifolia	roots, woody vine, broad leaves	eukaryotic multicellular	erect	green leaves, brown stem and roots	none evident
Monotropa uniflora	roots, stems, broad leaves	eukaryotic multicellular	erect	white throughout	fruits

76. The organism that evolutionarily is most closely related to *Smilax herbacea* is

(A) *Platismatia glauca*
(B) *Dryopteris spinulosa*
(C) *Picea rubens*
(D) *Smilax rotundifolia*
(E) *Monotropa uniflora*

77. Symbiosis is best illustrated by which of the following organisms?

(A) *Platismatia glauca*
(B) *Dryopteris spinulosa*
(C) *Picea rubens*
(D) *Smilax herbacea*
(E) *Smilax rotundifolia*

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78. Which of the following shows the simplest level of physical organization?

(A) *Funaria americana*
(B) *Monotropa uniflora*
(C) *Dryopteris spinulosa*
(D) *Picea rubens*
(E) *Smilax rotundifolia*

79. Which of the following is most likely a flowering plant?

(A) *Platismatia glauca*
(B) *Funaria americana*
(C) *Dryopteris spinulosa*
(D) *Picea rubens*
(E) *Monotropa uniflora*

80. The appearance of these plants in the burned area is an example of what biological process?

(A) Evolution by natural selection
(B) Succession
(C) Mutation
(D) Eutrophication
(E) Recombination

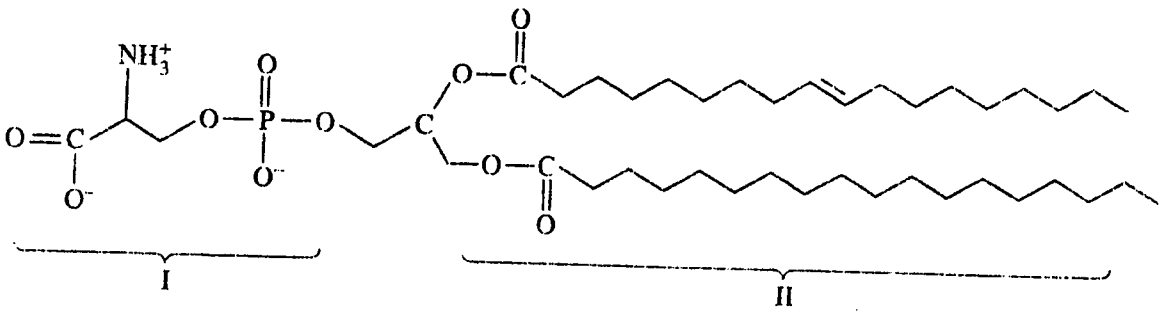
STOP

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THE ENTIRE BIOLOGY-E TEST.

BIOLOGY-M SECTION

If you are taking the Biology-M test, continue with questions 81-100.
Be sure to start this section of the test by filling in circle 81 on your answer sheet.

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Some questions pertain to a set that refers to a laboratory or experimental situation. For each question, select the one choice that is the best answer to the question and then fill in the corresponding circle on the answer sheet.



81. Which of the following is correct about the phospholipid shown above?

(A) Only I would be found in the middle of the lipid bilayer.
(B) Only II would be found in the middle of the lipid bilayer.
(C) Both I and II would be found in the middle of the lipid bilayer.
(D) II is hydrophilic.
(E) I and II are hydrophobic.

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82. Products of the light reactions of photosynthesis that later participate in the dark reactions of photosynthesis include which of the following?

I. Reduced NADP (NADPH)
II. ATP
III. O_2

(A) I only
(B) II only
(C) III only
(D) I and II only
(E) I, II, and III

83. The way in which an enzyme and its specific substrate interact is best described by the

(A) fluid-mosaic model
(B) induced-fit model
(C) Oparin hypothesis
(D) Lyon hypothesis
(E) competitive-exclusion principle

84. If a somatic cell in a diploid organism contains ten pairs of chromosomes, what is the total number of chromatids that are present in the cell after the DNA has replicated but before mitosis has taken place?

(A) 10
(B) 20
(C) 30
(D) 40
(E) 80

85. Which of the following atmospheric gases shows a net release during photosynthesis in plants?

(A) Carbon dioxide
(B) Oxygen
(C) Methane
(D) Hydrogen
(E) Nitrogen

86. Which of the following are the final products of fermentation?

(A) Carbon and oxygen
(B) Glucose and alcohol
(C) Carbon dioxide and oxygen
(D) Carbon dioxide and alcohol
(E) Oxygen and water

87. A function of transfer RNA is to

(A) receive the genetic information from nuclear DNA
(B) store the genetic information in the nucleus
(C) store RNA in the ribosomes
(D) transfer the genetic information from the nucleus to the cytoplasm
(E) position amino acids for protein synthesis by pairing with codons in messenger RNA

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88. Which of the following statements most accurately describes a basic difference between mitosis and meiosis?

(A) Homologous chromosomes form tetrads in mitosis but not in meiosis.
(B) Homologous chromosomes form tetrads in meiosis but not in mitosis.
(C) The nuclear membrane disappears in mitosis but not in meiosis.
(D) A spindle forms in mitosis but not in meiosis.
(E) A spindle forms in meiosis but not in mitosis.

89. The *Bt* protein produced in the bacterium, *Bacillus thuringiensis*, kills corn earworms that ingest the *Bacillus*. If the *Bt* gene were transferred to corn so that corn could express the *Bt* protein, which of the following would be expected to occur when corn earworms eat the corn?

I. Corn earworms that eat the *Bt* corn would be killed.
II. *Bacillus* bacteria that infect the *Bt* corn would be killed.
III. The corn earworms would incorporate the *Bt* gene into their chromosomes.

(A) I only
(B) II only
(C) III only
(D) I and III only
(E) II and III only

90. The wavelengths of light absorbed by chlorophyll are similar to the wavelengths of light that are associated with the greatest amount of oxygen release by plants. Based on these observations which of the following is a reasonable hypothesis about the function of chlorophyll?

(A) It plays a role in cell respiration.
(B) It plays a role in the light reactions of photosynthesis.
(C) It takes part in H_2O release.
(D) It takes part in CO_2 fixation.
(E) It generates energy.

91. Cellular respiration shares which of the following characteristics with the light-dependent reactions of photosynthesis?

(A) Production of ATP
(B) Production of AMP
(C) Production of GTP
(D) Production of oxygen
(E) Use of carbon dioxide in synthetic reactions

92. The position of a mutation in a gene and the location of an altered amino acid sequence in the corresponding protein are

(A) not related
(B) inversely related
(C) related in bacteria but not in mammals
(D) species-dependent
(E) in the same relative position

93. In order for an animal that was cloned from its mother to grow and develop normally, it must have received

(A) half of its mother's DNA sequences
(B) half of its father's RNA sequences
(C) all of its mother's RNA sequences
(D) all of its father's DNA sequences
(E) all of its mother's DNA sequences

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uestions 94-97

owls 1 and 7 — water only
owls 2 and 8 — water + 20 water plants
owls 3 and 9 — water + 40 water plants
owls 4 and 10 — water + 2 goldfish
owls 5 and 11 — water + 4 goldfish
owls 6 and 12 — water + 20 water plants + 2 goldfish

A biologist set up 12 bowls as described above. She exposed bowls 1 to 6 to light for 24 hours and placed bowls to 12 in the dark for 24 hours. She determined the CO_2 content of the water in micromoles per liter for each bowl the end of the 24 hours. The results are indicated below.

Experimental Results

Light		Dark	
Bowl #	$[CO_2]$	Bowl #	$[CO_2]$
1	10.0	7	10.2
2	4.3	8	13.7
3	2.1	9	16.9
4	14.9	10	14.1
5	18.3	11	17.9
6	10.2	12	19.2

4. The process responsible for the relatively low concentrations of CO_2 in bowls 2 and 3 is

(A) respiration
(B) fermentation
(C) photosynthesis
(D) photoperiodism
(E) transpiration

5. The main controls for bowl 4 are

(A) 1 and 3
(B) 1 and 6
(C) 1 and 10
(D) 2 and 5
(E) 2 and 8

96. The difference in CO_2 concentrations for bowls 2 and 6 can best be explained by

(A) photosynthesis carried out by water plants
(B) respiration carried out by water plants
(C) respiration carried out by goldfish
(D) competition between water plants and goldfish
(E) experimental error

97. Which of the following is the best explanation for the fact that the CO_2 concentration of bowl 4 is almost the same as that of bowl 10 and the CO_2 concentration of bowl 5 is almost the same as that of bowl 11 ?

(A) Photosynthesis does not occur in the light.
(B) Photosynthesis does not occur in the dark.
(C) Respiration and photosynthesis occur at the same rate in the light.
(D) Respiration is not affected by either light or dark.
(E) Goldfish are more active in the absence than in the presence of plants.

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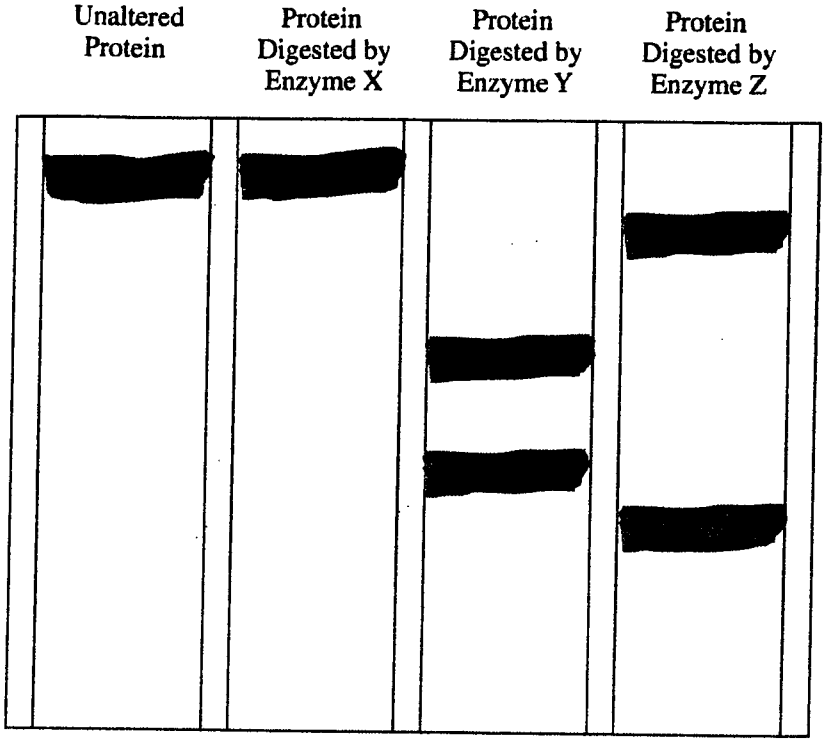
Questions 98-100 refer to the following experimental procedure.

A protein is purified from a frog embryo. The protein sample is divided into five fractions. One fraction is not treated. The other fractions are partially digested by using enzymes that act on specific amino acid sequences. In every case, the digestions are carried out at the appropriate temperature and pH. The samples are then separated b electrophoresis as shown below.



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98. In the electrophoresis experiment described, the distance moved by a fragment within the electric field is influenced by which of the following?

I. The number of amino acids in the fragment
II. The amount of electric current used in the apparatus
III. The porosity of the gel matrix

(A) I only
(B) II only
(C) I and II only
(D) II and III only
(E) I, II, and III

99. Which of the following techniques could have been used as an alternative to electrophoresis to separate the products of digestion with enzyme Z?

I. Translation
II. Chromatography
III. Serial dilution

(A) I only
(B) II only
(C) III only
(D) II and III only
(E) I, II, and III

100. Of the two fragments resulting from the digestion of the protein with enzyme Z, one is larger and the other is smaller than either of the fragments resulting from the digestion with enzyme Y. The most logical explanation for this is that

(A) the protein fragments produced by enzyme Y have the same molecular weights as those produced by enzyme Z
(B) proteins are produced by ribosomes
(C) enzymes Y and Z have different amino acid sequences
(D) electric current is divided into discrete units
(E) the protein is cut at different amino acid sequences by enzymes Y and Z

STOP

IF YOU FINISH BEFORE TIME IS CALLED, YOU MAY CHECK YOUR WORK ON THE ENTIRE BIOLOGY-M TEST.