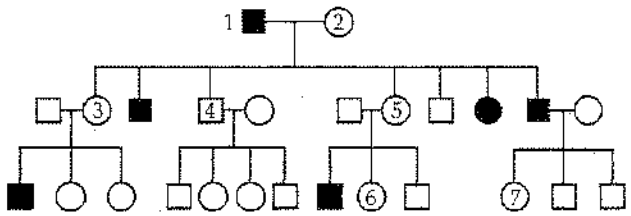
Practice Test 2

Biology
Section 1

Time—1 hour and 20 minutes

Directions: Each of the questions or incomplete statements below is followed by five suggested answers or completions. Select the one that is best in each case, and fill in the corresponding oval on the answer sheet.



1. Which of the following patterns of inheritance best explains the transmission of the trait in the pedigree above?
   (A) Sex-linked dominant
   (B) Sex-linked recessive
   (C) Autosomal dominant
   (D) Autosomal recessive
   (E) Incompletely dominant

2. A geneticist crosses two rabbits, both of which have brown fur. In rabbits, brown fur is dominant over white fur. Six of the eight offspring produced have brown fur, and the other two have white fur. The genotypes of the parents were most likely which of the following?
   (A) $BB \times bb$
   (B) $BB \times Bb$
   (C) $Bb \times bb$
   (D) $Bb \times Bb$
   (E) $bb \times bb$

3. Which of the following is an example of simple diffusion across a membrane?
   (A) The movement of H^+ across the thylakoid membrane during photosynthesis
   (B) The uptake of neurotransmitters by the postsynaptic membrane during the transmission of a nerve impulse
   (C) The movement of oxygen in the alveoli across the epithelial membrane and into the bloodstream
   (D) The exchange of sodium and potassium across a cell membrane through the Na^+-K^+ pump
   (E) The movement of glucose across the body cell membranes and the cells of the liver, which stores it as glycogen

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4. Which of the following correctly represents the order of the tissues through which water and minerals will pass on their way up from a plant's roots?
   (A) Root hair, endodermis (Casparian strip), epidermis, cortex, stele
   (B) Root hair, cortex, epidermis, endodermis (Casparian strip), stele
   (C) Root hair, stele, cortex, endodermis (Casparian strip), epidermis
   (D) Root hair, epidermis, stele, cortex, endodermis (Casparian strip)
   (E) Root hair, epidermis, cortex, endodermis (Casparian strip), stele

5. Which of the following evolved before algae?
   (A) Bacteria
   (B) Hydras
   (C) Cnidarians
   (D) Fungi
   (E) Protists

6. Insertions and deletions may cause which of the following types of mutation?
   (A) Missense mutation
   (B) Nonsense mutation
   (C) Gene substitution
   (D) Base-pair substitution
   (E) Frameshift mutation

7. The stomata—the openings on the underside of a plant leaf through which carbon dioxide is taken up and oxygen is expelled—are opened as a result of
   (A) movement of mesophylls away from the stomatal opening
   (B) increased turgidity in the guard cells
   (C) decreased turgidity in the guard cells
   (D) growth of the guard cells toward the mesophyll
   (E) elongation of the guard cells toward the mesophyll

8. Which characteristic is NOT required of a population in Hardy-Weinberg equilibrium?
   (A) The population must be very large.
   (B) There must be no migration into or out of the population.
   (C) The members of the population must be mating randomly.
   (D) There must be only two alleles present for each characteristic in the population.
   (E) Natural selection must not be operating in the population.

9. The mitotic spindle consists of microtubules and which structure?
   (A) Centromere
   (B) Centrosome
   (C) Cytoplasm
   (D) Kinetochore
   (E) Metaphase plate

10. In plants that undergo alternation of generations, the gametophyte stage is always
    (A) a large visible plant
    (B) a seed
    (C) diploid
    (D) haploid
    (E) unicellular

11. Bacteria reproduce by which of the following processes?
    (A) Mitosis
    (B) Meiosis
    (C) Binary fission
    (D) Binary division
    (E) Cleavage

12. All of the following are factors contributing to the ascent of water through the xylem in plants EXCEPT
    (A) transpiration
    (B) low water potential at one end
    (C) cohesion of water to the vessel walls
    (D) adhesion of water to the vessel walls
    (E) sources and sinks

13. In plants, the abscission, or dropping, of leaves is triggered by changes in
(A) cytokinin
(B) ethylene
(C) abscisic acid
(D) gibberellins
(E) brassinosteroids

14. Near the lungs, a branch from the pulmonary artery would contain which of the following?
(A) Oxygen-rich blood
(B) Oxygen-poor blood
(C) Dissolved nutrients from the stomach
(D) Blood rich in carbon monoxide
(E) Lymph

15. Gel electrophoresis can be used for which of the following laboratory procedures?
(A) Determining the molecular weight of proteins and nucleic acids
(B) Determining the charge of proteins and nucleic acids
(C) Separating nucleic acids and proteins on the basis of their size
(D) Separating nucleic acids and proteins on the basis of their charge
(E) Breaking up proteins and nucleic acids into their monomers

16. In humans, if red hair (*R*) is dominant to brown hair (*r*), and freckles (*F*) are dominant to no freckles (*f*), what fraction of the progeny of the cross *RrFf* × *RRff* will have red hair and no freckles?
(A) 9/16
(B) 1/2
(C) 3/8
(D) 3/16
(E) 1/16

17. Which of the following can be observed best by using a compound light microscope?
(A) Atoms and molecules
(B) Proteins
(C) Ribosomes
(D) Bacteria
(E) Viruses

18. The phenomenon by which plants will bend toward or away from a light source is known as
(A) photoaffinity
(B) taxis
(C) phototropism
(D) thigmotropism
(E) photophilia

19. All of the following are functions of microtubules in the cell EXCEPT
(A) components of cilia, used for locomotion
(B) components of flagellum, used for locomotion
(C) involvement in the movement of chromosomes during cell division
(D) components of the cytoskeleton, function in cell support
(E) part of the nuclear membrane

20. Which of the following organelles is the site of macromolecule hydrolysis in the cell?
(A) Mitochondria
(B) Centrosome
(C) Lysosome
(D) Golgi apparatus
(E) Ribosome

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21. Which of the following describes how a dog that is prodded while asleep will respond to the touch initially, but will eventually ignore repeated prodding?
(A) Habituation
(B) Imprinting
(C) Reasoning
(D) Instinct
(E) Trial and error

22. Which of the following is characteristic of a plant cell but not of an animal cell?
(A) Rough endoplasmic reticulum
(B) Cell membrane
(C) Ribosomes
(D) Large central vacuole
(E) Golgi apparatus

23. When a species is split into two populations, separated by a geographic barrier that makes breeding between the populations impossible, this could eventually lead to
(A) sympatric speciation
(B) allopatric speciation
(C) adaptive radiation
(D) polyploid speciation
(E) exaptation

24. The fact that pairs of alleles will segregate randomly during gamete formation describes which of the following laws?
(A) The law of segregation
(B) The law of independent segregation
(C) The law of equal inheritance
(D) The law of independent assortment
(E) The law of equal segregation

25. In cows, eye color is controlled by a single gene with two alleles. When a homozygous cow with brown eyes is crossed with a homozygous cow with green eyes, cows with blue eyes are produced. If the blue-eyed cows are crossed with each other, what fraction of their offspring will have brown eyes?
(A) 0
(B) ¼
(C) ½
(D) ¾
(E) 1

26. Which of the following is NOT an adaptation for gas exchange?
(A) Lungs
(B) Tracheal system
(C) Gills
(D) Moist epidermis
(E) Sinuses

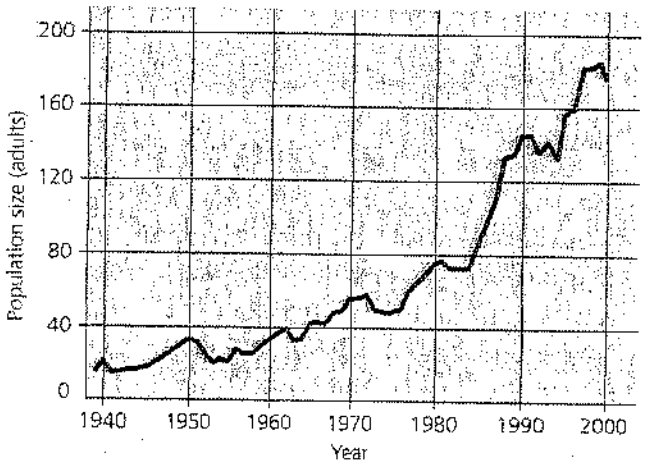
27. Which of the following best characterizes the reaction represented below?
$A + B \rightarrow AB + \text{energy}$
(A) Exergonic reaction
(B) Endergonic reaction
(C) Oxidation-reduction reaction
(D) Catabolism
(E) Hydrolysis

28. During prophase of mitosis, nuclear DNA is in which of the following forms?
(A) Daughter chromosomes
(B) Chromatin
(C) Chromosomes consisting of two sister chromatids
(D) Single sister chromatids
(E) Single linear chromosomes

29. One way to measure the metabolic rate of a cell would be to measure the rate at which
(A) CO_2 is consumed by the cell
(B) O_2 is consumed by the cell
(C) water is consumed by the cell
(D) O_2 is produced by the cell
(E) glucose is consumed by the cell

30. Which of the following is a site of translation in the cell?
(A) The nucleus
(B) The Golgi apparatus
(C) Smooth ER
(D) Rough ER
(E) Mitochondria

31. In certain plant cells, the synthesis of ATP occurs in which of the following?
(A) Ribosomes and mitochondria
(B) Ribosomes and chloroplasts
(C) Mitochondria and chloroplasts
(D) Mitochondria and the cytoplasm
(E) Chloroplasts and the cytoplasm



32. The graph above shows the rate of growth of a population of squirrels in a certain geographic area in Connecticut during the past several decades. This population is most closely exhibiting which of the following types of growth?
(A) Logistic growth
(B) Probable growth
(C) *r*-selected growth
(D) *K*-selected growth
(E) Exponential growth

33. Genes *M* and *N* are located on different chromosomes, and the probability of their undergoing crossing over is quite low. If the probability of allele *M* segregating into a gamete is ½, and the probability of allele *N* segregating into a gamete is ½, then the probability that both of them will segregate into the same gamete is
(A) ½
(B) ¼
(C) ⅛
(D) ¾
(E) 1

34. Two individuals who are carriers for cystic fibrosis (a recessively inherited disorder) have 3 children together. None of the children have cystic fibrosis. What is the probability that the couple's fourth child will be born with cystic fibrosis?
(A) 0%
(B) 25%
(C) 50%
(D) 75%
(E) 100%

35. Which of the following groups comprise a strand of DNA?
(A) Phosphate groups, deoxyriboses, and nitrogenous bases
(B) Phosphate groups, riboses, and nitrogenous bases
(C) Phosphate groups, deoxyriboses, and amino acids
(D) Phosphate groups, riboses, and amino acids
(E) Deoxyriboses and nitrogenous bases

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36. The statement that evolutionary changes are composed of rapid bursts of speciation that alternate with long periods in which species do not change significantly is known as
(A) gradualism
(B) punctuated gradualism
(C) punctuated equilibrium
(D) sympatric speciation
(E) allopatric speciation

37. Which of the following vertebrates lacks an amnion during its development?
(A) Bird
(B) Human
(C) Lizard
(D) Frog
(E) Alligator

38. Which of the following is capable of reverse transcription, with an RNA → DNA information flow?
(A) Viruses
(B) Retroviruses
(C) T cells
(D) B cells
(E) Ciliates

39. Compared with prokaryotic cells, eukaryotic cells are generally
(A) smaller but more complex
(B) larger and more complex
(C) smaller and less complex
(D) larger but less complex
(E) the same size but more complex

40. Which of the following plant hormones is responsible for stimulating stem elongation, root growth, and cell differentiation?
(A) Ethylene
(B) Abscisic acid
(C) Cytokinin
(D) Gibberellin
(E) Auxin

41. In terms of evolution, which of the following is closest to fungi?
(A) Plants
(B) Animals
(C) Archaea
(D) Bacteria
(E) Viruses

42. In humans, which of the following glands is responsible for secreting several hormones involved in reproduction?
(A) Thyroid gland
(B) Adrenal cortex
(C) Adrenal medulla
(D) Anterior pituitary
(E) Posterior pituitary

43. Which is thought to have been the first self-replicating genetic material?
(A) DNA
(B) RNA
(C) cDNA
(D) mRNA
(E) tRNA

44. When a break in the epidermal layer of humans occurs, which type of blood cell travels in great numbers to the break and releases clotting factors?
(A) Leukocytes
(B) Erythrocytes
(C) Helper T cells
(D) Helper B cells
(E) Platelets

45. In photosynthesis, the functional product(s) of the light reactions
(A) are ATP and NADPH
(B) are ATP and NADH
(C) is glyceraldehyde
(D) is glucose
(E) are carbohydrates

46. Which group is best characterized as being eukaryotic and saprophytic with hyphae?
(A) Protista
(B) Plantae
(C) Archaea
(D) Fungi
(E) Animalia

47. In humans, color blindness is a sex-linked recessive trait. If a man and a woman have a son who is color blind, which of the following must be true?
(A) The father is color blind.
(B) Both parents carry the allele for color blindness.
(C) Neither parent carries the allele for color blindness.
(D) The father carries the allele for color blindness.
(E) The mother carries the allele for color blindness.

48. If a horse breeds with a donkey, a mule is produced. Mules are not capable of breeding with either parental species, or each other. This is an example of what type of postzygotic barrier?
(A) Reduced hybrid viability
(B) Hybrid sterility
(C) Hybrid breakdown
(D) Mechanical isolation
(E) Gametic isolation

49. Radioactive isotopes can be used to date fossils. The amount of time it takes for half of a radioactive isotope to decay is also known as the substance's
(A) release rate
(B) radioactive decay rate
(C) half-life
(D) time scale
(E) decay rate

50. The female gametophytes of a plant develop in the ovaries of the plant, whereas the male gametophyte develops in which plant structure?
(A) Stigma
(B) Style
(C) Carpel
(D) Anther
(E) Sepal

51. Which of the following is the most direct result of the presence of salivary amylase in the mouth?
(A) The breakdown of proteins
(B) The breakdown of polypeptides
(C) The breakdown of lipids
(D) The breakdown of carbohydrates
(E) The breakdown of nucleic acids

52. The leaves of a plant appear green to us because
(A) chlorophyll reflects green light
(B) chlorophyll absorbs green light
(C) chlorophyll reflects red light
(D) chlorophyll reflects blue light
(E) chlorophyll is green, and plants contain hundreds of chlorophyll molecules

53. What bonds are responsible for ice being less dense than liquid water and water being a good insulator?
(A) Ionic
(B) Covalent
(C) Polar covalent
(D) Hydrogen
(E) Double

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54. Which of the following is the insulating layer wrapped around nerve cells that increases the speed of nerve impulse transmission?
(A) Axons
(B) Dendrites
(C) Synaptic terminal
(D) Myelin sheath
(E) Nodes of Ranvier

55. Which of the following is the substrate in the citric acid cycle?
(A) Carbon dioxide
(B) Acetyl CoA
(C) Citrate
(D) Oxaloacetate
(E) Glucose

56. Insects, spiders, and crustaceans are all classified in which phylum?
(A) Arthropoda
(B) Annelida
(C) Chordata
(D) Nemertea
(E) Cnidaria

Directions: Each group of questions below consists of five lettered choices followed by a list of numbered phrases or sentences. For each numbered phrase or sentence, select the one choice (or item) that is most closely related to it. Each choice may be used once, more than once, or not at all in each group.

Questions 57–59
(A) Meiosis II
(B) Meiosis I
(C) Binary fission
(D) Mitosis
(E) Interphase

57. The process during which prokaryotes reproduce

58. The process during which the diploid chromosome number is reduced by half

59. The process during which the genetic material of the cell is replicated

Questions 60–64
(A) Amphibia
(B) Reptilia
(C) Echinodermata
(D) Chordata
(E) Chondrichthyes

60. Members have cartilaginous skeletons and include sharks and sea rays.

61. Members have a water vascular system and include sea stars and sea cucumbers.

62. Members have eggs without shells, and some have a moist epithelium that participates in gas exchange.

63. Members have scales, lungs, and amniotic eggs.

64. Members have a notochord and pharyngeal clefts and include humans.

Questions 65–69
(A) Electron transport chain
(B) Chemiosmosis
(C) Glycolysis
(D) The citric acid cycle
(E) Light reactions of photosynthesis

65. Drives the synthesis of ATP through a hydrogen ion gradient

66. Occurs in all living cells and is the starting point for aerobic respiration and fermentation

67. Is part of cellular respiration and completes the breakdown of glucose into carbon dioxide

68. Shuttles electrons and releases energy that is used to make ATP

69. Photoexcited electrons pass from one photosystem to the next via an electron transport chain.

Questions 70–73

(A) Population
(B) Community
(C) Species
(D) Niche
(E) Biome

70. Members are capable of interbreeding and are anatomically similar.

71. The biotic and abiotic resources a species uses in its environment

72. Individuals of one species that live in a discrete geographic area

73. All the organisms that live within a discrete geographic area

Questions 74–78

(A) Antigens
(B) Antibodies
(C) Histamines
(D) Eosinophils
(E) Macrophages

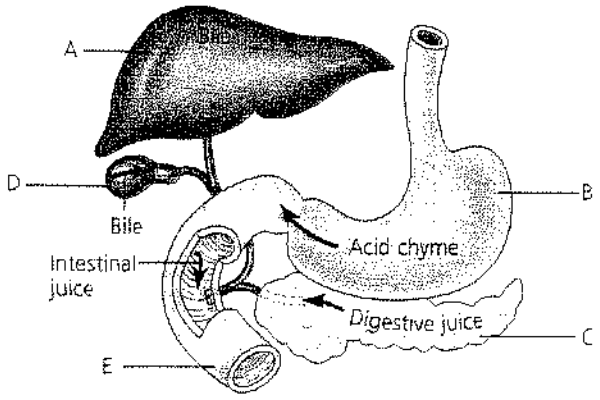
74. Large phagocytotic cells that engulf microbes

75. A type of white blood cell that damages invaders with destructive enzymes

76. Proteins that bind antigens

77. Foreign molecules that elicit an immune response

78. Chemical signals released in response to injury



Questions 79–83
Identify the letter pointing to each organ.

79. Stomach

80. Gallbladder

81. Duodenum

82. Pancreas

83. Liver

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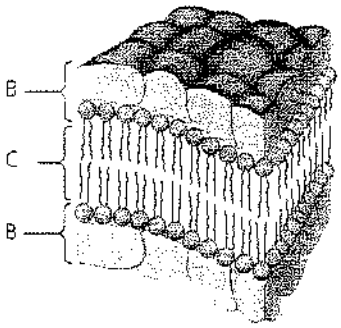
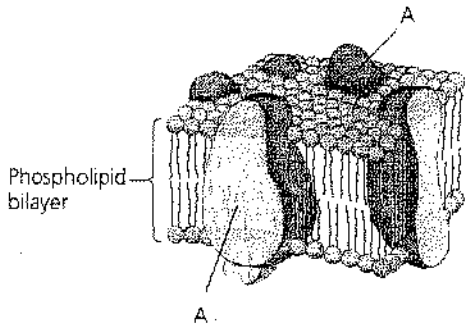
Questions 84–86
Identify the letter that points to each description.





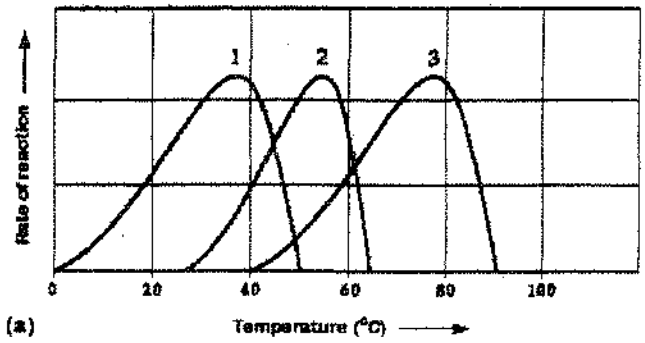
84. The hydrophilic zone of the plasma membrane

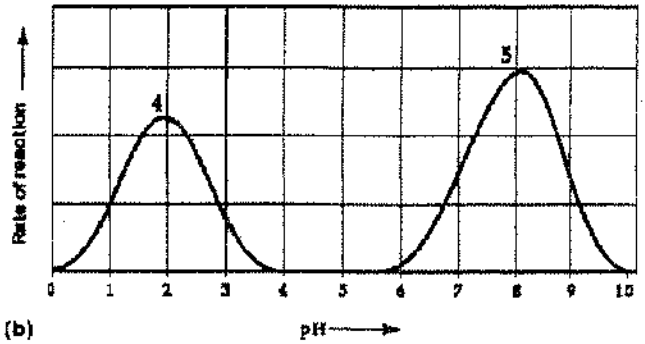
85. The hydrophobic zone of the plasma membrane

86. Allows for facilitated diffusion across the membrane

Directions: Each group of questions below concerns an experimental or laboratory situation or data. In each case, first study the description of the situation or data. Then choose the one best answer to each question following it.

Questions 87–89
The rate of reaction for 3 enzymes was calculated at different temperatures, and the rate of reaction for 2 additional enzymes was calculated at different pH levels. The results are shown in the following graphs. Assume that the *y*-axes share the same scale.





87. Which of the enzymes would most likely be able to function in the human bloodstream?
(A) 1 and 4
(B) 1, 2, and 4
(C) 1, 2, and 5
(D) 3 and 4
(E) 3 and 5

88. Which of the enzymes would be most likely to function in the geysers of Yellowstone National Park?
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

89. Which of these enzymes is most efficient—that is, has the highest rate of reaction?
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

Questions 90–92

A scientist studying the mammalian heart is experimenting on a white rat. She injects different radioactive elements into different sections of the rat's heart. The chart below lists where she injected each substance.

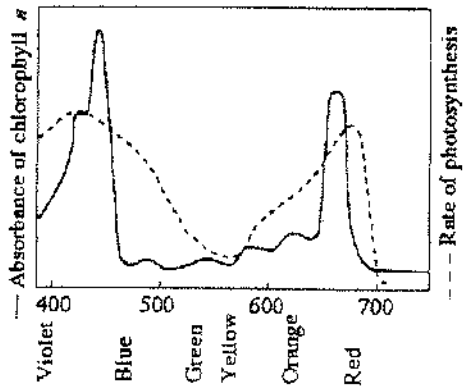
Heart chamber	Radioactive Isotope Used
Right ventricle	^{32}P
Right atrium	^{3}H
Left ventricle	^{14}C
Left atrium	^{238}U

90. Just after its injection, where would the radioactive isotope ^{238}U be detected first?
(A) Left ventricle
(B) Right ventricle
(C) Right atrium
(D) Systemic capillaries
(E) Pulmonary capillaries

91. Just after its injection, the blood injected with ^{14}C would be detected performing which of the following tasks in the body?
(A) Picking up oxygen from the systemic capillaries
(B) Transporting oxygen to systemic capillaries
(C) Picking up oxygen in the capillaries of the lungs
(D) Dropping off carbon dioxide in the capillaries of the lungs
(E) Delivering oxygen to the capillaries of the lungs

92. Just after its injection of ^{32}P, the blood injected with ^{32}P would be detected performing which of the following tasks in the body?
(A) Picking up oxygen from the systemic capillaries
(B) Delivering oxygen to the systemic capillaries
(C) Picking up oxygen in the capillaries of the lungs
(D) Dropping off carbon monoxide in the capillaries of the lungs
(E) Delivering oxygen to the capillaries of the lungs

Questions 93–94 refer to the graph shown below.



93. A biologist would use which of the following terms to refer to the solid line in the graph?
(A) Action spectrum
(B) Absorption spectrum
(C) Photostimulation curve
(D) Electromagnetic spectrum
(E) Visible light spectrum

94. Which of the following is the best reason the curve for the absorbency of light by chlorophyll *a* does not perfectly match the rate of photosynthesis?
(A) The rate of photosynthesis is always fractionally slower than the rate of absorbency by chlorophyll *a*.
(B) The rate of photosynthesis is always fractionally faster than the rate of absorbency by chlorophyll *a*.
(C) There are fewer chlorophyll *a* molecules in the cell than the other molecules involved in photosynthesis, so chlorophyll *a* is the rate-limiting reagent.
(D) Chlorophyll *a* is not the only photosynthetically important pigment in chloroplasts.
(E) Light of about 550 nm inhibits all photosynthesis.

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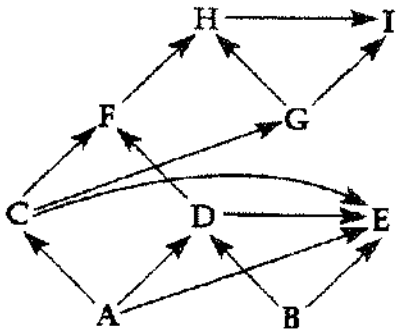
Questions 95–98

An ecologist studying a certain biogeographic area has sketched the following food web for the community that lives there. The arrows represent energy flow, the letters represent species.



95. Which of the following is most likely to be autotrophic?
    (A) E
    (B) A
    (C) I
    (D) G
    (E) D

96. Which members of the food web are secondary consumers?
    (A) D, E, and F
    (B) A, B, and C
    (C) G, H, and I
    (D) E, F, and G
    (E) B, D, and E

97. Which of the species in the food web are exclusively carnivores?
    (A) E, F, G, H, and I
    (B) F, G, H, and I
    (C) C, D, and E
    (D) F and G
    (E) H and I

98. If this were a savanna ecosystem, what organisms are species A and B most likely to represent?
    (A) Two species of small low-growing bushes
    (B) Two species of lichen
    (C) Two species of insects
    (D) Two species of rodent
    (E) Two species of grasses

Questions 99–100 refer to the following table, which shows the temperature at which the DNA of various species has been found to denature.

Species	Temperature at Which DNA Denatures
A	25°C
B	80°C
C	72°C
D	58°C
E	57°C

99. Which of the species in this table are most likely to be related most closely evolutionarily?
    (A) A and B
    (B) B and C
    (C) C and D
    (D) D and E
    (E) A and E

100. What other experimental method besides heating could be used to denature DNA strands in order to obtain the same type of information?
    (A) Adding a buffer to the DNA samples
    (B) Adding a solvent to the DNA samples
    (C) Slowly lowering the pH of the DNA samples
    (D) Slowly adding free bases to the DNA samples
    (E) Freezing the samples

END OF SECTION I

Biology
Section II

Time—10 minutes to plan responses; 1 hour and 30 minutes for writing

Answer all questions. Number your answers as the questions are numbered below.

Answers must be in essay form. Outline form is NOT acceptable. Labeled diagrams may be used to supplement discussion, but in no case will a diagram alone suffice. It is important that you read each question completely before you begin to write.

1. The cell membrane is one of the most important parts of a cell; it allows the selective passage of materials into and out of the cell, thereby maintaining a constant, desired internal composition.
   (a) **Discuss** the components of a typical animal cell membrane, as well as the roles each of these components plays in regulating the cell's internal environment.
   (b) **Discuss** the ways in which the following can enter an animal cell, including:
   - viral DNA.
   - hormones.
   - water molecules.

2. It is thought that the terrestrial plants we see around us today evolved from aquatic algae.
   (a) **Discuss** three obstacles to the movement of plants to land.
   (b) **Discuss** three adaptations that have evolved in terrestrial plants that combat the obstacles above.

3. **Describe** the process of cell division in a typical plant cell, including:
   (a) the cell cycle of a plant cell.
   (b) the process of mitosis.
   (c) cytokinesis.

4. It is theorized that glycolysis was the first metabolic pathway for the production of ATP.
   (a) **Provide** three pieces of evidence that support this point.
   (b) **Describe** how the citric acid cycle is related to chemiosmosis and oxidative phosphorylation.

END OF EXAMINATION

KEY – AP PRACTICE TEST #2 – Multiple Choice

1) B	26) E	51) D	76) B
2) D	27) A	52) A	77) A
3) C	28) C	53) D	78) C
4) E	29) B	54) D	79) B
5) A	30) D	55) B	80) D
6) E	31) C	56) A	81) E
7) B	32) E	57) C	82) C
8) D	33) C	58) A	83) A
9) B	34) B	59) E	84) B
10) D	35) A	60) E	85) C
11) C	36) C	61) C	86) A
12) E	37) D	62) A	87) C
13) B	38) B	63) B	88) C
14) B	39) B	64) D	89) E
15) C	40) E	65) B	90) A
16) B	41) B	66) C	91) B
17) D	42) D	67) D	92) C
18) C	43) B	68) A	93) B
19) E	44) E	69) E	94) D
20) C	45) A	70) C	95) B
21) A	46) D	71) D	96) D
22) D	47) E	72) A	97) B
23) B	48) B	73) B	98) E
24) D	49) C	74) E	99) D
25) B	50) D	75) D	100) C