1986
AP Biology Examination

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 then blacken the corresponding space on the answer sheet.

1. The introduction of antibiotics such as penicillin several years ago was immediately effective in combating infections caused by *Staphylococcus.* In 1958, however, there were several outbreaks of staphylococcal infections. People with the infections did not respond to treatment with any of the antibiotics and there was a large number of deaths. The best explanation for this situation is that
   (A) the bacteria reproduced in hosts that were not contaminated with antibiotics
   (B) the bacteria from other hosts such as birds, cats, and dogs migrated into human hosts
   (C) the bacteria exposed to nonlethal doses of antibiotics quickly learned to avoid them
   (D) each generation of bacteria acquired the ability to use antibiotics as nutrients
   (E) antibiotic-resistant bacteria survived and multiplied, and these were the forms causing the infections

2. As part of an experiment to investigate the effects of cadmium on the hearts and livers of rats, the experimental group of rats receives 5 parts per million of cadmium in their drinking water each day. The control rats are given water from which all cadmium has been removed. For the experiment to be valid all of the following conditions are necessary EXCEPT:
   (A) The rats should eat the same kinds and amounts of food.
   (B) The experimental and control rats should be the same age and have the same body weight.
   (C) The rats should be housed under the same conditions of temperature and humidity.
   (D) The control rats should receive water fortified with other minerals to make up for the cadmium loss.
   (E) The rats should be members of the same species.

3. Which of the following is LEAST likely to be a factor in the movement of water through a terrestrial plant?
   (A) The cohesion of water
   (B) The influence of gibberellin on cell expansion
   (C) Capillary action
   (D) Root pressure
   (E) The evaporation of water from the leaves

4. The external similarity of dolphins to sharks is an example of
   (A) convergent evolution
   (B) divergent evolution
   (C) behavioral isolation
   (D) geographic isolation
   (E) adaptive radiation

5. Competitive exclusion is most likely to occur between two
   (A) closely related species occupying different niches
   (B) closely related species occupying the same niche
   (C) related species occupying different habitats
   (D) unrelated species occupying different niches
   (E) populations of the same species

6. Which of the following sequences describes the passage of a nerve impulse through a simple reflex arc in humans?
   (A) Receptor, sensory neuron, motor neuron, association neuron, effector
   (B) Receptor, motor neuron, association neuron, sensory neuron, effector
   (C) Receptor, sensory neuron, association neuron, motor neuron, effector
   (D) Effector, motor neuron, association neuron, sensory neuron, receptor
   (E) Receptor, association neuron, sensory neuron, motor neuron, effector

7. A scientist measured the water content of leaves from two different groups of oak trees on three different summer days. One group of leaves, the T group, came from trees that had been defoliated by gypsy moths the previous year. The other leaves, the C group, came from trees that had not been defoliated. The results, in milliliters of water per gram of dry weight, are shown in the table below.

	June 10	June 10	July 28
T Group	26.8	20.4	12.7
C Group	32.5	28.7	22.7

   All of the following are valid interpretations of these data EXCEPT:
   (A) C leaves typically contain more water than do T leaves.
   (B) Both C and T leaves show declines in water content as the summer goes on.
   (C) T leaves show greater declines in water content than do C leaves.
   (D) Defoliation by gypsy moths has no effect on the water content of next year's leaves.
   (E) Differences in the water content between C and T leaves grow greater as the summer goes on.

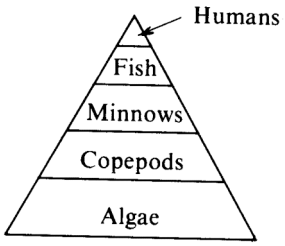
8. If red hair, blue eyes, and freckles were consistently inherited together, the best explanation would be that
   (A) these traits are recessive characteristics
   (B) both parents have red hair, blue eyes, and freckles
   (C) the genes for these traits are linked on the same chromosome
   (D) gene duplications have occurred
   (E) these traits are dominant to others

9. Vertebrates became truly terrestrial with the development of the amniotic egg in
   (A) fish
   (B) amphibians
   (C) reptiles
   (D) birds

(E) mammals

10. If the larvae of a particular species of mosquito are to survive to the adult stage, the eggs must be laid in the trapped pool of water of the northern pitcher plant. The mosquito larvae provide no apparent benefit or harm to the pitcher plant. This type of interaction is an example of
    (A) commensalism
    (B) predation
    (C) parasitism
    (D) mutualism
    (E) competition

11. A human genetic defect that affects the ability to metabolize a particular amino acid is
    (A) phenylketonuria
    (B) hemophilia
    (C) sickle cell anemia
    (D) Down's syndrome
    (E) Turner's syndrome



12. In the food pyramid above, which of the following organisms are herbivores?
    (A) Humans
    (B) Fish
    (C) Minnows
    (D) Copepods
    (E) Algae

13. All of the following affect the amount of oxygen carried by the blood EXCEPT
    (A) the pH of the blood
    (B) the percentage of carbon dioxide in the plasma
    (C) the percentage of oxygen in the air
    (D) a decrease in the number of red blood cells in the plasma
    (E) a decrease in the number of white blood cells in the plasma

14. Species that utilize the same source of nutrition within a food web can best be described as
    (A) providing double links in a food chain
    (B) being homeothermic relative to energy flow
    (C) occupying the same trophic level
    (D) being secondary consumers within a complex food web
    (E) being autotrophs, heterotrophs, or omnivores

15. A species of malaria-carrying mosquito lives in a forest in which two species of monkeys, A and B, coexist. Species A is immune to malaria but species B is not. The malaria-carrying mosquito is the chief food for a particular kind of bird in the forest. If all of these birds are eliminated suddenly by hunters, which of the following would be the immediate observable consequence?
    (A) Increased mortality in monkey species A
    (B) Increased mortality in monkey species B

(C) Increased mortality in the malaria-carrying mosquitoes
(D) Emergence of malaria-resistant strains in monkey species B
(E) Emergence of malaria-sensitive strains in monkey species A

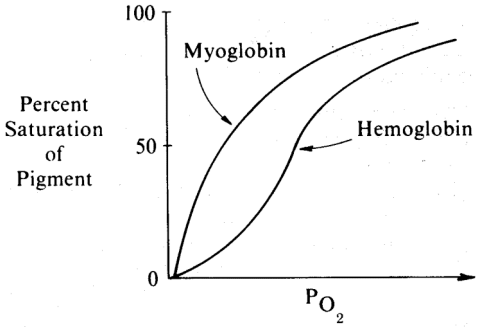
16. Monogamy is usually more common among birds and mammals whose young are
(A) born helpless and in need of much parental care
(B) precocial and able to care for themselves
(C) hatched from among thousands of eggs
(D) nourished on milk
(E) carried by the female from conception to birth

17. Root hairs are extensions of which of the following kinds of cells?
(A) Cortical
(B) Xylem
(C) Phloem
(D) Epidermal
(E) Meristematic

18. Mitosis in flowering plants is similar to mitosis in animals in that in both
(A) a cell plate forms
(B) synapsis of homologous chromosomes occurs
(C) large centrioles attach to the spindle fibers
(D) each daughter cell has half the number of chromosomes found in each parent cell
(E) centromeres uncouple and chromosomes move apart

19. The function of the acrosome of the sperm is to
(A) orient the pattern of the microtubules for motility
(B) carry genetic information
(C) carry the enzymes that facilitate fertilization
(D) provide energy for movement
(E) regulate protein synthesis in the sperm

20. The "all-or-none" law, as it applies to impulse transmission, states which of the following?
(A) If a stimulus is applied, either all neurons fire or none do.
(B) A stimulus causes either all the sodium to leak into the neuronal membrane or none of it.
(C) Either all neurons develop an action potential upon stimulation or none do.
(D) If a stimulus is at or above the threshold, an action potential will be generated; if not, then the neuron will not fire.
(E) Either all neurons will be repolarized or none will be.



21. From the graph above, it can be correctly concluded that
(A) hemoglobin has an affinity for oxygen that varies with the carbon dioxide concentration
(B) myoglobin and hemoglobin have distinctly different molecular weights

(C) hemoglobin becomes saturated with oxygen at lower partial pressures than does myoglobin
(D) myoglobin has a greater affinity for oxygen at lower partial pressures than does hemoglobin
(E) hemoglobin and myoglobin regulate the partial pressures of oxygen in the blood

22. All of the following are deuterostomes EXCEPT
(A) mollusks
(B) reptiles
(C) amphibians
(D) echinoderms
(E) mammals

23. A new species of organism has evolved when
(A) the climate of a population's area has changed greatly
(B) a population can no longer interbreed under natural conditions with other closely related organisms
(C) variation has occurred within the species due to mutations
(D) a population has been recently isolated from the rest of the species by a geographic barrier
(E) selection pressures have produced a group of demes

24. Carbon dioxide is passed into a solution of bromthymol blue indicator until the acid solution turns yellow. A sprig of elodea is then placed into this yellow solution. After a few hours in the sunlight, the yellow solution turns blue. The purpose of this experiment is to show that
(A) oxygen is given off during photosynthesis
(B) carbon dioxide is used during photosynthesis
(C) carbon dioxide is given off as a by-product of photosynthesis
(D) bromthymol blue changes to bromthymol yellow under acid conditions
(E) chlorophyll acting as a photocatalyst is necessary for photosynthesis

25. In traveling from a forest ecosystem to a grassland, one notes that the trees gradually give way to prairie grasses. The critical factor governing this shift is usually the
(A) length of the growing season
(B) annual mean temperature
(C) availability of carbon dioxide
(D) availability of water
(E) availability of oxygen

26. Which of the following statements concerning respiration is correct?
(A) Aerobic respiration is probably more ancient in an evolutionary sense than is anaerobic respiration.
(B) When oxygen is absent, fermentation proceeds without the participation of enzymes.
(C) Each NADH + H^+ generated in the Krebs cycle contains sufficient energy for the production of 3 ATP molecules.
(D) Unlike pyruvic acid, fatty acids break up into 3-carbon units during respiration.
(E) In one turn of the citric acid cycle, 8 molecules of CO_2 are formed.

27. Which of the following statements about a typical aquatic angiosperm is correct?
(A) It forms spines.
(B) It has fleshy leaves for water storage.
(C) It has extensive taproot systems.
(D) It has stomata in sunken cavities.
(E) It has stomata on the upper leaf surfaces.

28. Girdling of a tree by completely removing a ring of bark most directly affects the process of
(A) translocation
(B) transpiration
(C) photosynthesis

(D) countercurrent exchange
(E) cellular respiration

29. All of the following are examples of the benefits of bacteria to humans EXCEPT
(A) vitamin manufacture in the large intestine
(B) bacterial action in the making of silage
(C) bacterial action in the making of exotoxins
(D) the production of drugs such as streptomycin
(E) the production of acids that flavor cheese

30. During development, individual cells of the same organism begin to produce different proteins because
(A) the cells have different numbers of chromosomes
(B) not all cells can synthesize proteins
(C) specific genes are activated in the cells
(D) the cells have different kinds and amounts of DNA
(E) genes are permanently lost as somatic cells differentiate

31. When a person exercises strenuously, all of the following occur EXCEPT:
(A) Glucose decreases.
(B) ADP increases.
(C) Lactic acid increases.
(D) Glycogen increases.
(E) CO_2 increases.

32. Actinomycin D is an antibiotic drug that inhibits protein synthesis by blocking transcription. In some cells, the application of the drug does not affect the synthesis of certain proteins. Which of the following best explains such an occurrence?
(A) Not all proteins need tRNA molecules for their synthesis.
(B) The proteins that are made are using mRNA synthesized before application of the drug.
(C) Nuclear proteins do not require the cytoplasmic machinery of ribosomes.
(D) DNA transcription is not necessary for protein synthesis.
(E) Protein synthesis is blocked in the cytoplasm at the ribosome level.

33. All of the following statements about a chloroplast and a mitochondrion are true EXCEPT:
(A) Both use proton gradients for energy production.
(B) Both capture light energy.
(C) Both contain DNA.
(D) Both are bounded by two unit membranes.
(E) Both synthesize ATP.

34. Human identical twins develop when
(A) two identical eggs are fertilized by two different sperm
(B) a single egg is fertilized by two sperm
(C) two different eggs are fertilized by two different sperm
(D) the embryo splits and each portion continues to develop
(E) a diploid egg is fertilized by a diploid ovum

35. In which organism in the food chain above would the biological magnification of DOT concentration be most obvious?
(A) Grass
(B) Cricket
(C) Prairie chicken
(D) Coyote

(E) Vulture

36. In a population at equilibrium, thousands of eggs and hundreds of tadpoles are produced by a single pair of frogs. About how many offspring will live to maturity and reproduce?
    (A) 0
    (B) 2
    (C) 10-20
    (D) 100
    (E) More than 100

37. According to the Jacob-Monod model of the lac operon, the regulator gene does which of the following?
    (A) Specifies the amino acid sequence of the enzyme.
    (B) Controls the activity of histones.
    (C) Determines whether promoter genes will be translated.
    (D) Directs the synthesis of a repressor protein.
    (E) Produces corepressor substances.

38. The use of the isotope ^{32}P as a tracer element in the study of invasion and lysis of bacteria by bacteriophage viruses has shown that
    (A) ATP from bacteriophages is identical to ATP found in eukaryotic cells
    (B) bacteriophage protein enters the bacteria through the cell wall
    (C) bacteriophage nucleic acids enter bacteria prior to lysis
    (D) ^{32}P accelerates the lytic effect of bacteriophage infection
    (E) ^{32}P in an inactive form enters the bacterial genome as part of a plasmid

39. A study of the metabolic rate in a terrestrial community shows that the energy released by respiration exceeds the energy captured in photosynthesis. Which of the following situations is occurring?
    (A) Community biomass is decreasing.
    (B) Community biomass is increasing.
    (C) A climax community has been reached.
    (D) The first law of thermodynamics is not in effect.
    (E) The second law of thermodynamics is not in effect.

40. Which of the following led most directly to a decrease in the amount of ultraviolet radiation reaching the Earth's surface?
    (A) Fermentation
    (B) Heterotrophs
    (C) Anaerobic respiration
    (D) Photosynthesis
    (E) A reducing atmosphere

41. All of the following conditions would result in a change in the frequency of a specific allele in a population EXCEPT
    (A) selection against the recessive phenotype
    (B) selection against the dominant phenotype
    (C) genetic drift
    (D) random mating in a large population
    (E) mutation of the dominant allele to the recessive allele

42. Hormones stimulate the uterine lining to thicken in preparation for
    (A) ovulation
    (B) fertilization
    (C) lactation
    (D) menstruation
    (E) implantation

43. Flowering in plants such as tobacco and cocklebur and the germination of certain lettuce seeds are induced primarily by
    (A) photoperiodism
    (B) temperature
    (C) negative feedback
    (D) circadian rhythms
    (E) lunar phases

44. Prokaryotes differ from eukaryotes in that only the prokaryotes contain
    (A) mitochondria in which glucose is oxidized
    (B) DNA that is not bound to histone protein
    (C) chromosomes enclosed within a nuclear envelope
    (D) photosynthetic pigments in plastids
    (E) plasma membranes surrounding the cytoplasm

45. Eutrophication in lakes is frequently the direct result of
    (A) nutrient enrichment
    (B) industrial poisons
    (C) a diminished supply of nitrates
    (D) an increase in predators
    (E) decreased light penetration

46. Many birds, insects, and terrestrial reptiles excrete nitrogenous wastes in the form of uric acid that
    (A) is synthesized in the kidneys from ammonia and CO_2
    (B) forms crystals that are relatively insoluble and nontoxic
    (C) readily decomposes on exposure to air
    (D) is readily excreted through feathers and scales
    (E) can be recycled and utilized as an additional energy source

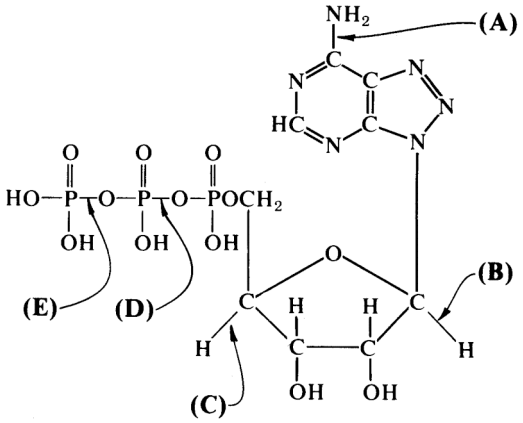
47. All of the following are examples of countercurrent exchange mechanisms EXCEPT
    (A) heat exchange in the limbs of seals and whales
    (B) heat exchange in the legs of wading birds
    (C) gas exchange in the gills of fish
    (D) gas exchange in the alveoli of humans
    (E) chloride transport in the loop of Henle of humans

48. In a certain group of African people, 4 percent are born with sickle cell anemia. What percentage of the group has the selective advantage of being more resistant to malaria than those individuals who are homozygous for normal hemoglobin or for sickle cell anemia?
    (A) 2%
    (B) 4%
    (C) 8%
    (D) 16%
    (E) 32%

49. The red underbelly of a male stickleback, which induces the aggressive behavior of another male during the breeding season, is called
    (A) a conditioned reflex
    (B) a fixed action pattern
    (C) an instinct
    (D) a reinforcer

(E) a releaser

Questions 57-59 refer to the diagram below.



50. The structure above could be any of the following EXCEPT a
    (A) nucleotide
    (B) monomer used as a component of a polypeptide
    (C) reactant used in the synthesis of nucleic acids
    (D) molecule of adenosine triphosphate
    (E) molecule that is the energy source for most anabolic activity in cells

51. During muscle contraction the molecule in the diagram is converted into
    (A) cyclic AMP + phosphate
    (B) pyruvic acid + CO_2
    (C) glycogen
    (D) ADP + phosphate
    (E) acetyl-CoA + CO_2

52. So-called high-energy bonds include the bonds at
    (A) A and B only
    (B) Band C only
    (C) C and D only
    (D) D and E only
    (E) B, C, D, and E

Directions: Each group of questions below consists of five lettered headings followed by a list of numbered phrases or sentences. For each numbered phrase or sentence select the one heading that is most closely related to it and blacken the corresponding space on the answer sheet. Each heading may be used once, more than once, or not at all in each group.

Questions 60-61

(A) Imprinting
(B) Habituation
(C) Conditioning
(D) Exploratory behavior
(E) Insight learning

53. A porpoise learns to do a somersault above the water whenever a fish is presented to the porpoise by its trainer. C

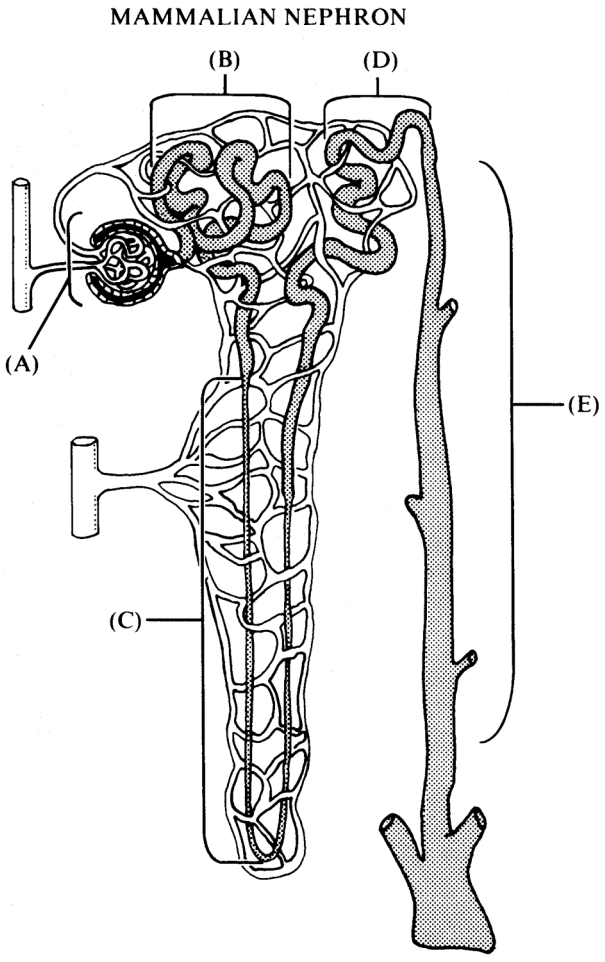
54. This form of behavior develops during a genetically programmed sensitive period. A

Questions 62-64

55. This is the primary site of glucose reabsorption. B

56. The blood is filtered at this site. A

57. This structure varies in length in desert and aquatic mammals. C



Questions 65-67

(A) Glucagon
(B) Insulin
(C) Epinephrine
(D) Glucocorticoids
(E) Thyroxine

58. A polypeptide that lowers the level of blood glucose by increasing the permeability of cell membranes to glucose B

59. An iodinated amino acid that increases the oxygen consumption and metabolic rate of nearly all cells E

60. A substance produced by the alpha cells of the pancreatic islets and involved in the increase of glycogenolysis in the liver A

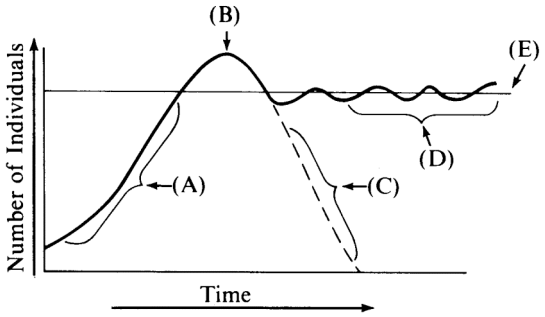
Questions 68-69

(A) Axon
(B) Dendrite
(C) Glial cell
(D) Synapse
(E) Interneuron

61. Conducts impulses away from the cell body of a neuron A

62. Forms the myelin sheath C

Questions 70-73 refer to the graph below that shows the changes in population size over time.



63. A mature, well-established population in favorable conditions D

64. The carrying capacity of the environment E

65. A population in unfavorable conditions C

66. The exponential growth phase of a new population A

Questions 74-75

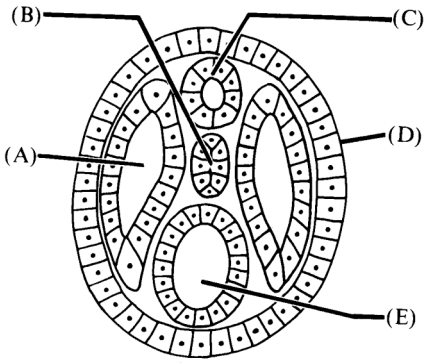
(A) 1/l6
(B) 1/4
(C) 1/2
(D) 9/16
(E) 1

Galactosemia is a simple, inherited, autosomal recessive trait. A normal couple has a child affected with galactosemia. For each of the following situations, select from the list above the appropriate probability.

67. The probability that the next two children will both be affected with galactosemia A

68. The probability that the father of the galactosemic child is heterozygous for the recessive allele E

Questions 76-79 refer to the following cross section of a developing organism with very little yolk.



69. Is the notochord B

70. Becomes the gut E

71. Becomes the coelom A

72. Gives rise to the outer skin D

Questions 80-83

(A) Angiosperms
(B) Gymnosperms
(C) Mosses
(D) Ferns
(E) Green algae

73. These represent the most primitive tracheophytes. D

74. Fruit development assists in seed dispersal. A

75. These produce naked seeds. B

76. The sporophyte generation consists of a foot, a stalk, and a single sporangium that remains attached to the dominant gametophyte. C

Questions 84-85 refer to a cell whose normal diploid number is 32.

(A) 8
(B) 16
(C) 32
(D) 64
(E) 128

77. What would be the chromatid number of a cell in late Prophase I of meiosis? D

78. How many chromosomes would each daughter cell have at the end of Telophase II of meiosis? B

Questions 86-89

(A) Founder effect
(B) Kin selection
(C) Competitive exclusion
(D) Adaptive radiation
(E) Convergent evolution

79. The evolution of several species from a single species, each occupying a different niche D

80. The survival, through apparently altruistic behavior, of related individuals with common alleles B

81. The establishment of a genetically unique population through genetic drift A

82. The independent development of similarities between unrelated groups resulting from adaptation to similar environments E

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

Questions 90-92

A laboratory study is conducted to test the conditions under which red-spotted newts can regenerate forelimbs. The forelimbs are amputated immediately proximal to the elbow. All the animals are maintained in aerated pond water at 21° Celsius and are provided with equal amounts of food. The data are summarized in the table below.

Experiment	Number of Newts	Light Conditions (at 100 lux)	Relative Amounts of Regeneration After 8 Weeks
1	30	Constant light	Greatest
2	30	Alternating 12 hours of light with 12 hours of darkness	Intermediate

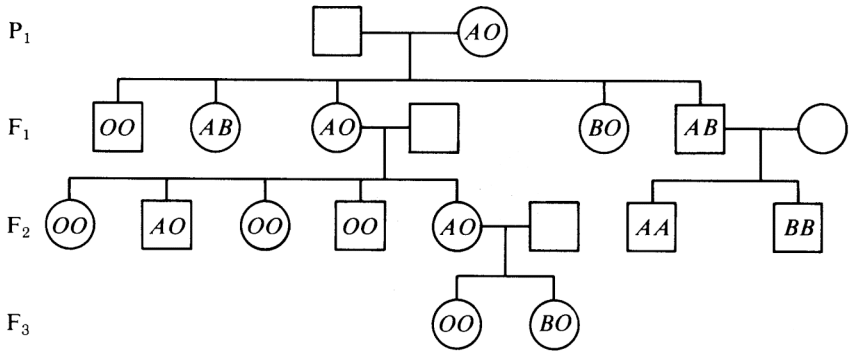
3	30	Constant darkness	Least

83. From the results of this study, it can be correctly concluded that the growth of regenerating forelimbs is affected by
    (A) cellular respiration
    (B) exposure to light
    (C) the quantity of food
    (D) the environmental temperature
    (E) light intensity

84. To determine whether the normal functioning of optic photo receptors is involved in limb regeneration, one should compare the results above with those obtained from a similar experiment with newts
    (A) that have both eyes blindfolded
    (B) that are maintained under constant light of 1,000 lux
    (C) that are maintained under light of 100 lux for 6 hours and then 6 hours of darkness
    (D) whose forelimbs have not been amputated
    (E) whose olfactory nerves have been severed

85. Some investigators suggest that the differences in the growth of forelimbs described above reflect the amount of adrenocorticotropic hormone secreted by the newts. To attempt to test this hypothesis, one should compare the results above with those obtained from a similar experiment with newts
    (A) deprived of their adrenal glands
    (B) deprived of the posterior pituitary glands
    (C) deprived of their gonads
    (D) injected with thyroid hormones
    (E) injected with brain extract

Questions 93-95 refer to the pedigree below in which females are indicated by circles and males are indicated by squares.



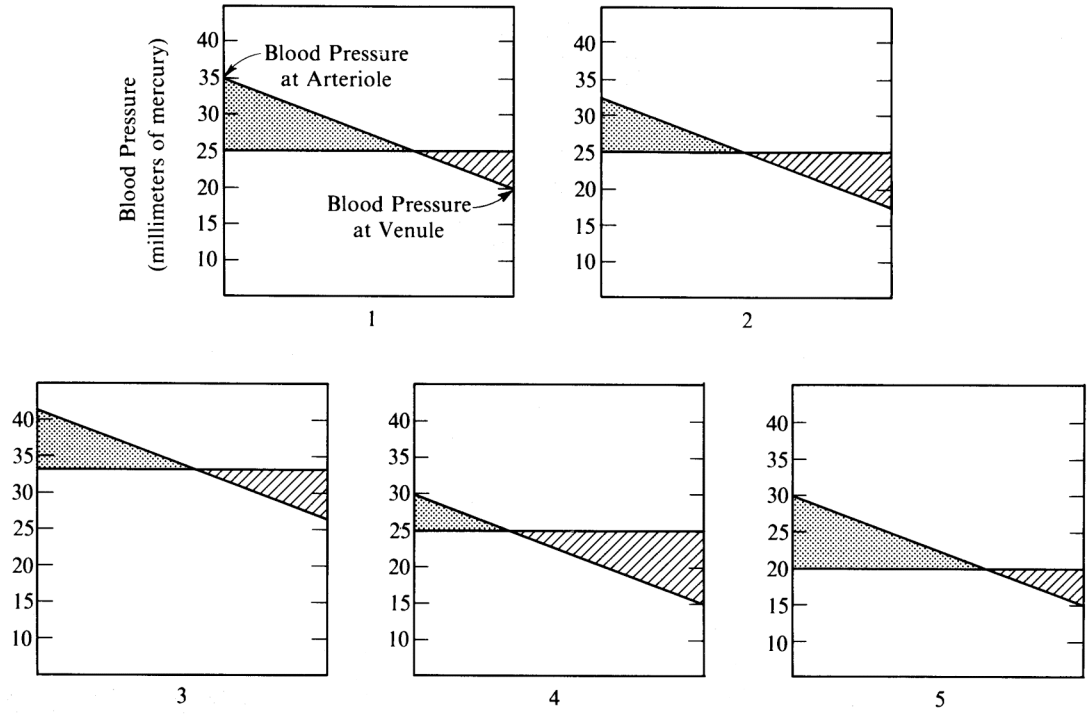
86. The genotype of the P_1 male must be
    (A) *OO*
    (B) *AO*
    (C) *BO*
    (D) *AB*
    (E) *AA*

87. The only other possible genotype for children of the F_1 *AB* male would be
    (A) *OO*
    (B) *BO*

(C) *AO*
(D) *AA*
(E) AB

88. The most likely genotype of the mate of the F_1 *AO* female is
(A) *AB*
(B) *BB*
(C) *OO*
(D) *AA*
(E) *BO*

Questions 96-97 refer to the diagrams below that show the volume of fluid lost (stippled area) or gained (cross-hatched area) from the blood as it flows through the capillary from arteriole to venule. The horizontal line represents blood osmotic pressure. Normal blood osmotic pressure measures 25 millimeters of mercury.

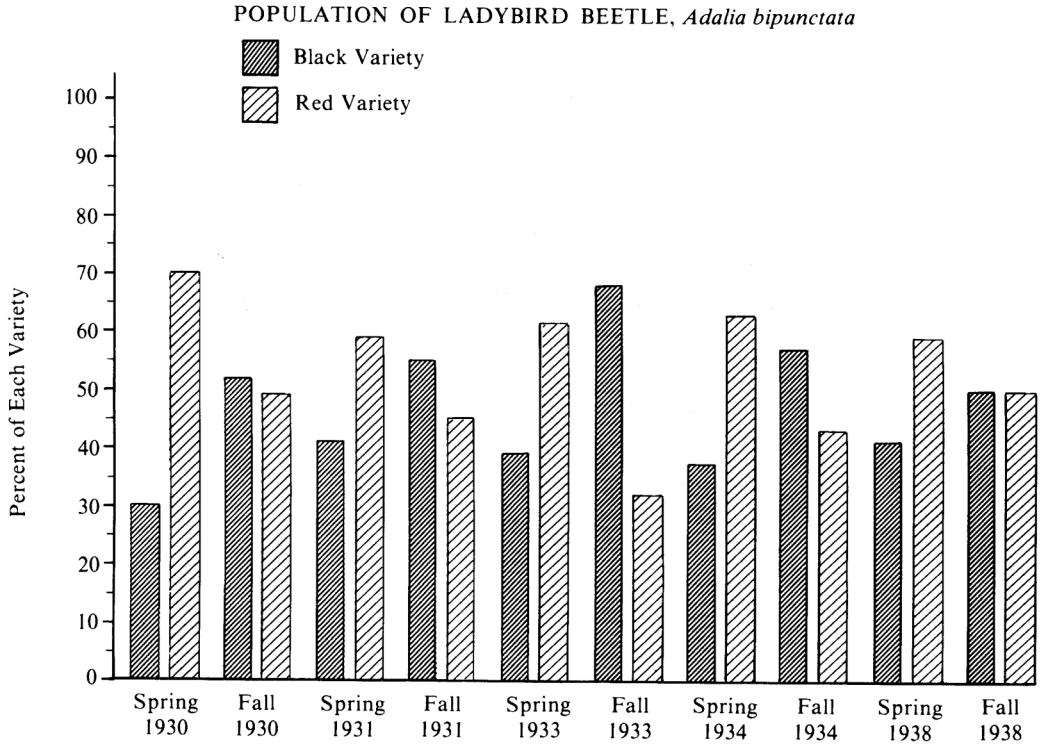


89. Which of the diagrams represents the normal condition, in which the amount of fluid lost from capillaries due to blood pressure is equal to the amount of fluid gained by capillaries due to osmotic pressure?
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

90. Which of the diagrams best represents excessively high blood pressure caused by changes in blood osmotic pressure?
(A) 1
(B) 2
(C) 3
(D) 4

(E) 5

Questions 98-99 refer to the following graph.



91. Which of the following statements about this population is correct?
    (A) This is an example of heterozygote superiority.
    (B) This is an example of balanced polymorphism.
    (C) The red beetles feed on the black beetles.
    (D) The gene frequency of the black variety is increasing overall.
    (E) There is no differential mortality.

92. The most likely conclusion from the information in the graph is that
    (A) ladybird beetles mate in the fall, but the eggs do not hatch until the following spring
    (B) two different species are involved
    (C) there are more red beetles in the fall than in the spring of each year
    (D) the allele for red color is codominant with the allele for black
    (E) one variety may be adaptively superior at one time and the other variety at another time

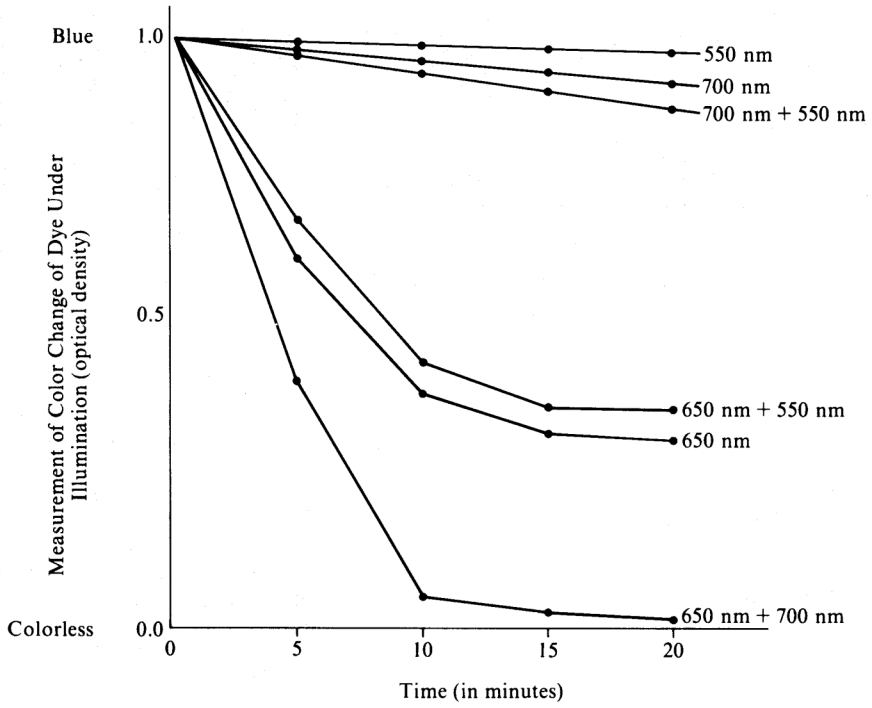
Questions 100-101

Intact chloroplasts are isolated from blended spinach leaves by low-speed centrifugation and are suspended in a cold, protective buffer. If these chilled chloroplasts are illuminated in the presence of an oxidized colored dye, one may observe the reduction of the dye as the dye loses its color.

$$\text{Oxidized blue dye} \xrightarrow[\text{light}]{\text{chloroplast}} \text{Reduced colorless dye}$$

$$\text{Oxidized blue dye} \xrightarrow{\text{light only}} \text{Oxidized blue dye}$$

An experiment is set up to determine the optimal reduction potential of the chloroplasts under different wavelengths of light energy. The chloroplast suspensions are individually or simultaneously exposed to the following wavelengths of light by the use of special filters: 550 nanometers (green), 650 nanometers (red), and 700 nanometers (far-red). All exposures are at the same light intensity. The data are given below.

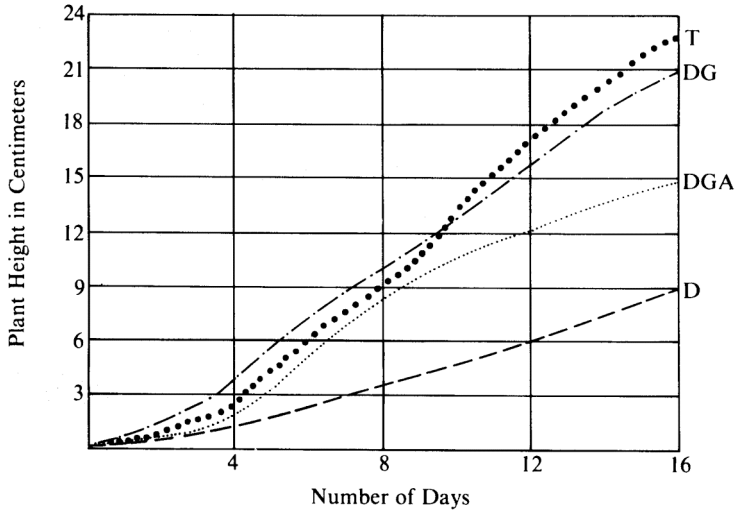


93. According to these data, which of the wavelengths of light energy provides the LEAST energy potential for photosynthesis?
    (A) 550 nm only
    (B) 650 nm only
    (C) 700 nm only
    (D) 550 nm and 650 nm
    (E) 650 nm and 700 nm

94. The greatest reduction of the blue dye by two different wavelengths of light suggests which of the following?
    (A) There are two pigment systems present within the same chloroplast, both absorbing at the same wavelength.
    (B) There are at least two pigment systems with different absorption spectra present within the same chloroplast.
    (C) Different portions of the plant (stems, leaves, etc.) absorb light from different wavelengths.
    (D) Both red and far-red light are transmitted.
    (E) Most photosynthesis occurs in green light.

Questions 102-105

Seeds given various treatments are planted in small pots. The height of each seedling is measured at 4-day intervals beginning with day 4 and ending with day 16. The graph below is an illustration of the data obtained. A key to the seed type and treatment is shown below the graph.



D = Dwarf pea plant seeds-no treatment
DG = Dwarf pea plant seeds soaked in gibberellic acid (gibberellin)
DGA = Dwarf pea plant seeds soaked in gibberellic acid and indoleacetic acid (auxin)
T = Tall, nondwarf pea plant seeds—no treatment

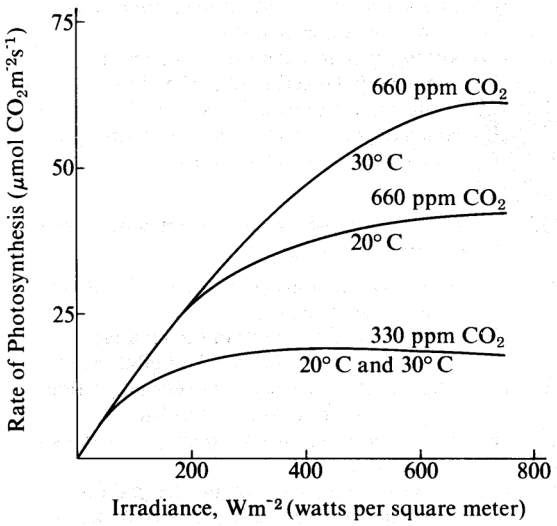
95. At day 8 of the experiment, all of the following statements are correct EXCEPT:
    (A) The T, DG, and DGA seedlings are very similar in height.
    (B) The eventual greater height of the T seedlings over the DG seedlings is already predictable.
    (C) The D seedlings are less than half as tall as the other seedlings.
    (D) The DG seedlings are taller than the T seedlings.
    (E) The T, DG, and DGA seedlings appear to be in a more rapid growth phase than the D seedlings.

96. A hypothesis that these data tend to support would be that
    (A) tallness is dominant over dwarfness
    (B) gibberellin and auxin both stimulate cell elongation
    (C) auxin promotes cell division
    (D) D pea seedlings lack amounts of gibberellin sufficient for achieving tall stature
    (E) gibberellic acid alters the gene structure of pea seeds

97. After examination of the data, it would probably be safe to say that the
(A) differences in plant height between the T and the D plants are not significant
(B) D seedlings will not mature and produce new seeds
(C) DGA pea plants have longer internodes than the other plants do
(D) auxin concentration used counteracts partially the action of gibberellin on the growth of dwarf seedlings
(E) stems of the T plants are not as strong as those of the DG plants

98. Of the following, which can be concluded from the experimental data?
(A) The DG seedlings grew almost as tall as the T seedlings.
(B) The T seedlings contain the greatest concentration of auxin and gibberellin.
(C) The DGA seedlings will eventually catch up in growth to the T seedlings.
(D) The T seedlings are homozygous dominant for tallness.
(E) There will be a less obvious height difference between DG and DGA seedlings at 20 days than at 16 days.

Questions 106-108
The graph below shows the relationship of photosynthetic rate and irradiance (light intensity) as it is influenced by both temperature and carbon dioxide level.



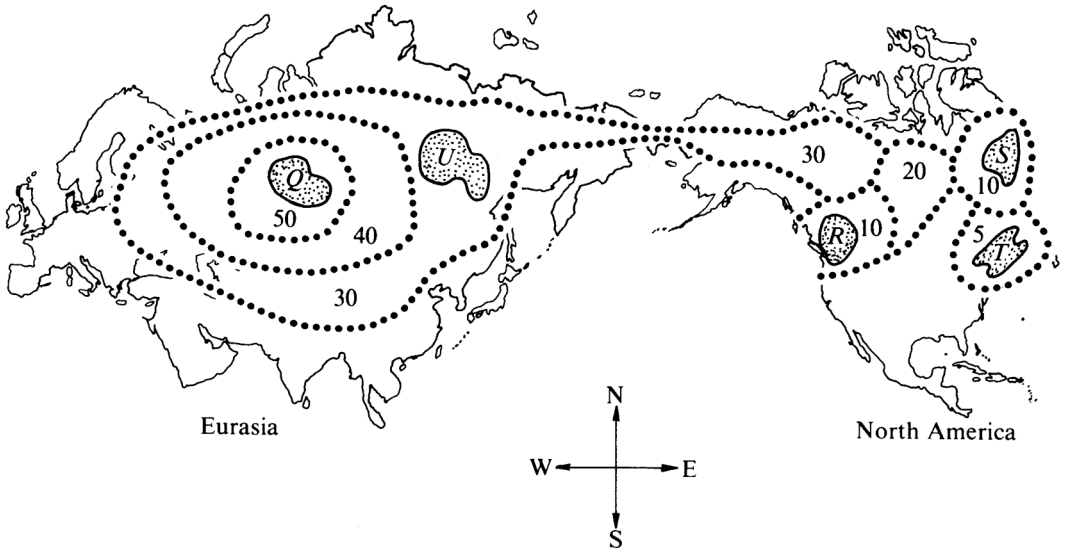
99. According to the graph, the greatest rate of photosynthesis occurs when CO_2 is present at
(A) high concentrations and low temperatures
(B) low concentrations and high temperatures
(C) high concentrations and low irradiance levels
(D) low concentrations and high irradiance levels
(E) high concentrations and high irradiance levels

100. From the data in the graph, which of the following conclusions is most reasonable?
(A) The rate of photosynthesis is inversely proportional to light intensity.
(B) The rate of photosynthesis at 660 ppm CO_2 is more dependent on temperature than the rate at 330 ppm CO_2.
(C) There is no theoretical maximum for the rate of photosynthesis.
(D) Attempts to increase the photosynthetic yield in field crops should involve the lowering of CO_2 levels.

(E) Photosynthesis is unaffected by temperature.

101. Which of the following seems most likely from the data?
(A) Light produces heat, which causes increases in the rates of photosynthesis.
(B) Light causes the saturation of cytochrome oxidase, which then limits the use of CO_2.
(C) The photosynthetic rate could be increased further by decreasing the CO_2 concentration.
(D) Increasing irradiance levels above 800 Wm^{-2} would have less effect on the rate of photosynthesis than would increasing the CO_2 concentration.
(E) The rate of photosynthesis at 25° C and 660 ppm CO_2 would be the same as that observed at 20° C and 660 ppm CO_2.

Questions 109-111 refer to the map below of the distribution of several populations on the continents of Eurasia and North America. These populations were derived from a common ancestral species. The area enclosed by a given dotted line represents the distribution of the population and the numbers in millions of years refer to the earliest fossil evidence found within the bounded area. Present populations are found only in the shaded areas.



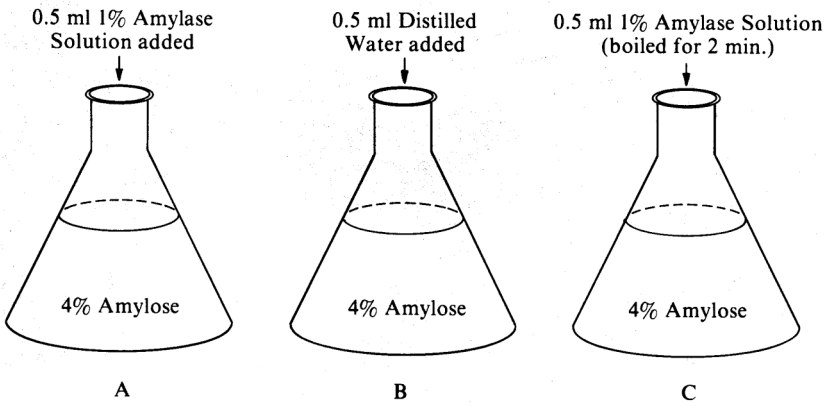
102. The oldest existing population is found at
(A) Q
(B) R
(C) S
(D) T
(E) U

103. The two existing populations that are apparently the most closely related are
(A) Q and R
(B) Q and S
(C) Q and T
(D) R and U
(E) S and T

104. The data indicate which of the following about the area occupied by the original species?
(A) It increased steadily.
(B) It decreased steadily.
(C) It increased and then decreased.

(D) It decreased and then increased.
(E) It remained relatively stable.

Questions 112-114
A biologist prepares an in vitro analysis of the activity of the enzyme amylase, which promotes the hydrolysis of polysaccharides to monosaccharide residues. Three flasks containing 5 milliliters of 4 percent amylose (starch) in water are prepared with the addition at time zero of each of the substances indicated in the diagrams below.



105. In an experiment to test the effect of amylase on starch, the control would be
(A) flask A only
(B) flask B only
(C) flask C only
(D) flasks A and B
(E) flasks A and C

106. After 2 minutes, a positive test for sugar would most likely be observed in
(A) flask A only
(B) flask B only
(C) flask C only
(D) flasks A and C
(E) flasks Band C

107. Support for the hypothesis of enzyme denaturation can be obtained by comparing starch digestion in
(A) flasks A and B after 5 minutes
(B) flasks Band C after 5 minutes
(C) flasks A and C after 5 minutes
(D) flask A at time zero and again after 5 minutes
(E) flask B at time zero and again after 5 minutes

Questions 115-117 refer to the chart below that indicates general animal body plans.

	Ectoderm	Mesoderm	Endoderm	Radial Symmetry	Pseudocoelom	True Coelom	Endoskeleton	Exoskeleton
Type 1	+	+	+			+		+
Type 2	+	+	+					
Type 3	+	+	+		+			
Type 4	+	+	+			+	+	
Type 5	+		+	+				

Note: + indicates presence in an organism.

108. The body plan associated with arthropods is type
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

109. The body plan associated with nematodes is type
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

110. The body plan associated with flatworms is type
(A) 1
(B) 2
(C) 3
(D) 4
(E) 5

Questions 118-120 refer to information in the following table.

Second Letter

First Letter (5′ End)	U	C	A	G	Third Letter (3′ End)
U	UUU phe	UCU ser	UAU tyr	UGU cys	U
	UUC phe	UCC ser	UAC tyr	UGC cys	C
	UUA leu	UCA ser	UAA stop	UGA stop	A
	UUG leu	UCG ser	UAG stop	UGG trp	G
C	CUU leu	CCU pro	CAU his	CGU arg	U
	CUC leu	CCC pro	CAC his	CGC arg	C
	CUA leu	CCA pro	CAA gln	CGA arg	A
	CUG leu	CCG pro	CAG gln	CGG arg	G
A	AUU ile	ACU thr	AAU asn	AGU ser	U
	AUC ile	ACC thr	AAC asn	AGC ser	C
	AUA ile	ACA thr	AAA lys	AGA arg	A
	AUG met	ACG thr	AAG lys	AGG arg	G
G	GUU val	GCU ala	GAU asp	GGU gly	U
	GUC val	GCC ala	GAC asp	GGC gly	C
	GUA val	GCA ala	GAA glu	GGA gly	A
	GUG val	GCG ala	GAG glu	GGG gly	G

111. A single substitution in the third position would have the greatest probability of mutational effect on the codon
(A) GUU
(B) AUU
(C) CGU
(D) AUG
(E) CCC

112. Which amino acid has the greatest number of codons?
(A) Leucine (leu)
(B) Proline (pro)
(C) Tryptophan (trp) *
(D) Glutamic acid (glu)
(E) Aspartic acid (asp)

113. Some geneticists consider the third base of a codon to be less important than the first two bases as a code for a specific amino acid. All of the following observations would support this hypothesis EXCEPT:
   (A) Any of the bases following a CC_ sequence will position a proline.
   (B) Even though the A is replaced by a C, the triplet AGG will still position to an arginine.
   (C) Even though the last A is replaced by a G, the triplet UAA will still terminate a polypeptide chain.
   (D) An AUU triplet codes for isoleucine, while a UUU triplet codes for phenylalanine.
   (E) There are three codons, any of which will position an isoleucine.

Answer Key and Percent Answering Correctly
Section I
1986 AP Biology Examination

The correct answers to the multiple-choice questions and the percentage of AP candidates who answered each question correctly are given below. As a general rule, candidates who chose the correct answers to each individual question also received a higher mean score on the test as a whole than did candidates who chose the wrong answers.

Item No.	Correct Answer	Percent Correct	Item No.	Correct Answer	Percent Correct	Item No.	Correct Answer	Percent Correct
1	E	91%	41	B	37%	81	A	75%
2	E	85%	42	D	28%	82	B	63%
3	D	87%	43	C	44%	83	C	49%
4	B	74%	44	A	30%	84	D	40%
5	A	66%	45	D	35%	85	B	63%
6	D	69%	46	D	60%	86	D	43%
7	B	80%	47	E	53%	87	B	53%
8	D	82%	48	A	50%	88	A	48%
9	C	70%	49	B	46%	89	E	67%
10	E	80%	50	A	26%	90	B	92%
11	D	79%	51	B	34%	91	A	56%
12	C	72%	52	D	16%	92	A	67%
13	C	79%	53	C	33%	93	C	90%
14	C	55%	54	E	24%	94	E	74%
15	A	76%	55	E	18%	95	C	87%
16	A	61%	56	B	16%	96	B	91%
17	D	79%	57	B	32%	97	C	64%
18	E	74%	58	D	45%	98	B	56%
19	C	70%	59	D	67%	99	E	76%
20	B	79%	60	C	79%	100	A	56%
21	A	61%	61	A	67%	101	B	52%
22	D	58%	62	B	31%	102	B	80%
23	E	36%	63	A	71%	103	D	51%
24	C	38%	64	C	46%	104	D	84%
25	D	55%	65	B	56%	105	A	79%
26	D	53%	66	E	48%	106	E	84%
27	A	24%	67	A	37%	107	B	62%
28	B	62%	68	A	62%	108	D	49%
29	B	61%	69	C	65%	109	A	94%
30	D	73%	70	D	68%	110	E	93%
31	C	53%	71	E	53%	111	C	36%
32	E	43%	72	C	86%	112	B	66%
33	A	30%	73	A	82%	113	A	38%
34	C	42%	74	A	48%	114	C	58%
35	C	74%	75	E	59%	115	A	78%
36	D	65%	76	B	44%	116	C	30%
37	B	40%	77	E	51%	117	B	26%
38	B	67%	78	A	30%	118	D	58%
39	D	77%	79	D	87%	119	A	75%
40	E	40%	80	D	33%	120	B	46%

An answer sheet gridded with the correct responses appears on the next page.