# TEST 2

# BIOLOGY E/M TEST

FOR BOTH BIOLOGY-E OR BIOLOGY-M

ANSWER QUESTIONS 1-60

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

Questions 1-4 refer to the following:

(A) Characteristics of plants but not animals
(B) Characteristics of animals but not plants
(C) Characteristics of eukaryotes but not prokaryotes
(D) Characteristics of prokaryotes but not eukaryotes
(E) Characteristic of all organisms

1. The cells of an organism contain mitochondria
2. The cells of an organism contain ribosomes
3. The cell wall is composed of cellulose
4. The cytosol of an organism's cells is contained in the plasma membrane

Questions 5-9 refer to the following

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

5. The number of different phenotypes possible for the progeny of the cross *Aa x aa*
6. The % probability that expectant parents who already have two daughters will have another daughter
7. The smallest number of generations required to obtain a 9:3:3:1 ratio of phenotypes starting with parents having the genotypes *AABB* and *aabb*
8. The number of different gametes that could be produced by an individual with the genotype *AaBb*
9. The number of chromatids in a cell at prophase I of meiosis for *Drosophila melanogaster*, whose haploid chromosome number is 4

Questions 10-13

(A) Agglutination
(B) Acclimation
(C) Passive immunity
(D) Allergic reaction
(E) Active immunity

10. Protection of a newborn mammal by antibodies from its mother's milk

11. Symptoms often caused in humans by the release of histamine

12. The clumping reaction of anti B antibodies with type B red blood cells.

13. Long term resistance to chicken pox acquired after infection with chicken pox virus.

Questions 14-15 refer to the following

(A) Glycolysis
(B) Kreb's cycle
(C) Fermentation
(D) Chemiosmosis
(E) Electron transport chain

14. Process that produces pyruvic acid

15. Process that can produce lactic acid

Directions: each of the questions or incomplete statements below is followed by five suggested answers or completion. 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.

16. A geneticist wishes to determine whether a black guinea pig carries the recessive gene for white fur. Which of the following would best reveal the possible presence of the masked recessive trait?

(A) Examining the undersurface of the guinea pig for white hairs dispersed among the black
(B) Studying one of the guinea pig's hair follicles with an electron microscope
(C) Analysing the skin cells of the guinea pig chemically for the nature of its mRNA
(D) Examining the bands in the guinea pig's salivary gland chromosomes
(E) Mating the black guinea pig with a white one observing whether any of the offspring are white

17. Which of the following can increase genetic variability by the exchange of segments between homologous chromosomes

(A) mutation
(B) linkage
(C) Polyploidy
(D) Nondisjunction
(E) Crossing-over

18. Although Albermarle Island is situated only 600 miles west to Ecuador, this volcanic island contains many animals that are not found in Ecuador. This fact illustrates the effects of:
(A) Evolutionary changes in isolated populations
(B) A marine environment on animal life
(C) A disease-free environment
(D) Volcanic soils on animal life
(E) Great temperature differences between the islands of Ecuador

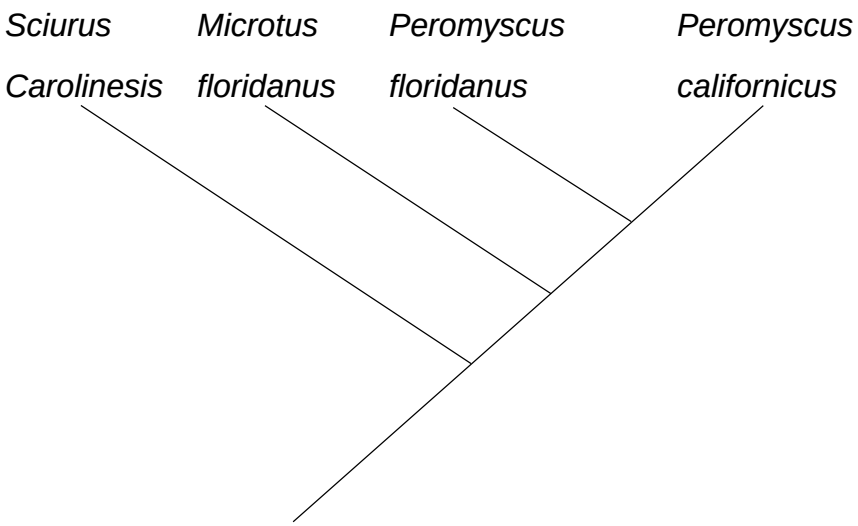
19. In mammal, the pitch of sound is distinguished by which of the following mechanisms?

(A) Different pitches cause different sections of the basilar membrane to vibrate
(B) Different frequencies of sound waves go to different semi-circular canals
(C) Different pitches affect either the hammer, the anvil, or the stapes
(D) The cochlea vibrates faster with lower pitch
(E) The tympanic membrane selects a specific pitch for sending auditory impulses

| | ***G*** | ***g*** |
|---|---|---|
| ***G*** | *GG* | *Gg* |
| ***g*** | *Gg* | *gg* |

20. In the cross represented in the Punnet square above, G is the allele for green, and g is the allele for yellow. Assuming a large number of offspring. The Punnet square predicts that

(A) 25% of the offspring will be yellow
(B) 25% of the offspring will not survive
(C) 50% of the offspring will be homozygous yellow
(D) 50% of the offspring will be homozygous green
(E) 75% of the offspring will be heterozygous green




21. According to the diagram above, in which of the following pairs are the species most closely related?

(A) *Peromyscus floridanus* and *Sciurus Carolinesis*
(B) *Peromyscus floridanus* and *Microtus floridanus*
(C) *Peromyscus californicus* and *Peromyscus floridanus*
(D) *Microtus floridanus* and *Sciurus Carolinesis*
(E) *Peromyscus californicus* and *Sciurus Carolinesis*

22. Animals obtain usable energy from all of the following molecules EXCEPT:

(A) Fatty acids
(B) Amino acids
(C) Glycerol
(D) Urea
(E) Fructose

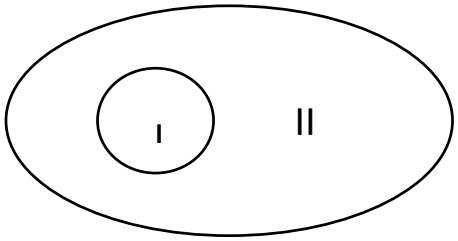
23. During a muscle contraction, the proteins actin and myosin slide along each other to decrease the lengths of the myofibril. Which of the following molecules is directly responsible for the movement of myosin relative to actin?
(A) Glucose
(B) ATP
(C) NADH
(D) ADP
(E) $NAD^+$

24. A symbiotic relationship between two species that is beneficial to both is defined as

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

25. Which of the following is always required for successful reproduction in multicellular plants or animals?

(A) Nonmotile egg and sperm
(B) Gametes that are haploid
(C) A zygote produced by mitosis
(D) Two pairs of chromosomes per gamete
(E) Two pairs of centrioles




26. If the diagram above illustrates a relationship between existing taxonomic groups, which of the following is best illustrated by the diagram?

| | Group I | Group II |
|---|---|---|
| (A) | Species | Species |
| (B) | Species | Genus |
| (C) | Genus | Species |
| (D) | Order | Genus |
| (E) | Phylum | Class |

27. Which of the following organisms appeared earliest on earth?

(A) Ferns
(B) Mosses
(C) Fungi
(D) Bacteria
(E) Lichens

28. Which of the following represents the normal path of blood flow in mammals?

(A) Lungs, right atrium, left atrium, right ventricle, left ventricle, aoerta
(B) Right atrium, lungs, left atrium, right ventricle, left ventricle, aoerta
(C) Right atrium, lungs, left atrium, left ventricle, right ventricle, aoerta
(D) Right atrium, right ventricle, lungs, left atrium, left ventricle, aoerta
(E) Left atrium, left ventricle, lungs, right atrium, right ventricle, aoerta

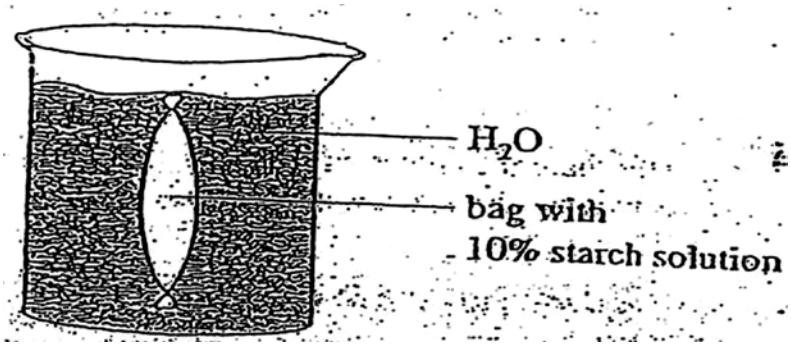
29. Which of the following organisms maintain constant body temperature metabolically?

(A) Rattle snake
(B) Salamander
(C) Lizard
(D) Ostrich
(E) Trout

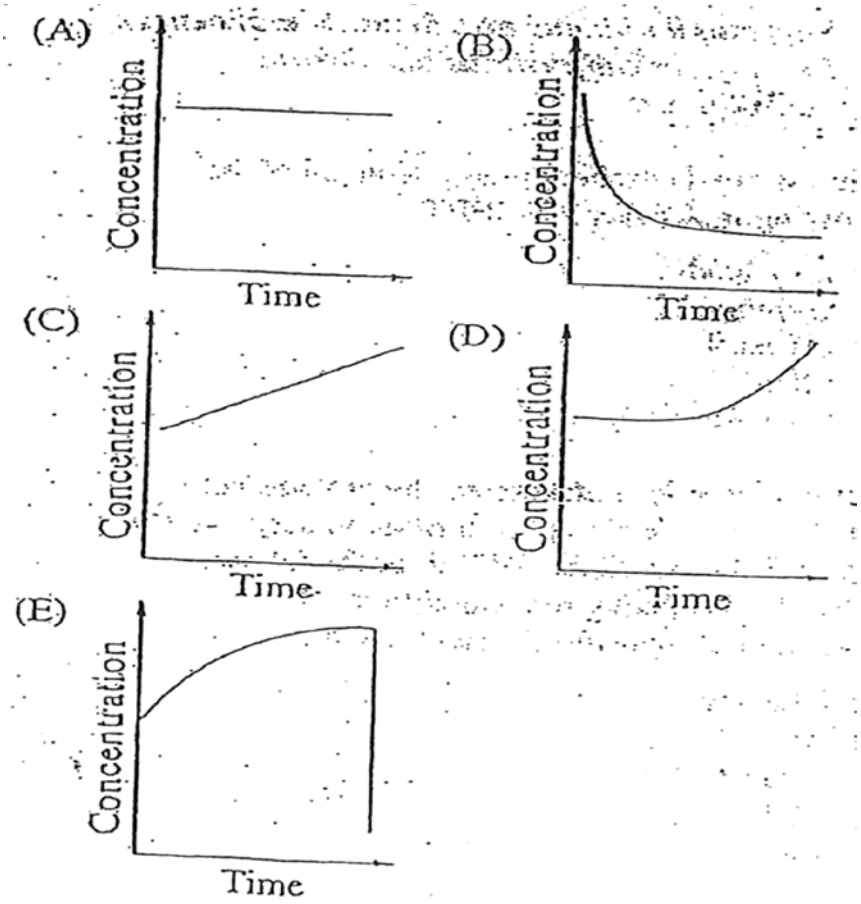
30. In the human digestive tract, the principle role of the colon is to

(A) Digest fats
(B) Secrete bile, which emulsifies fats
(C) Supply the enzymes that completes cellulose digestion
(D) Absorb most of the water from undigested material
(E) Inhibits the bacterial decomposition of solid wastes

31. A bag made of a semipermeable membrane, which serves as a model for a cell membrane, is filled with 10% starch solution. Like cell membranes, this bag is permeable to water but not permeable to starch. The bag is suspended in a beaker of distilled water for thirty minutes, as indicated in the diagram.




Which of the following graphs represents what would be expected to happen to the starch concentration in the bag?



32. Of the following, which is most likely to result in new alleles that arise in population?

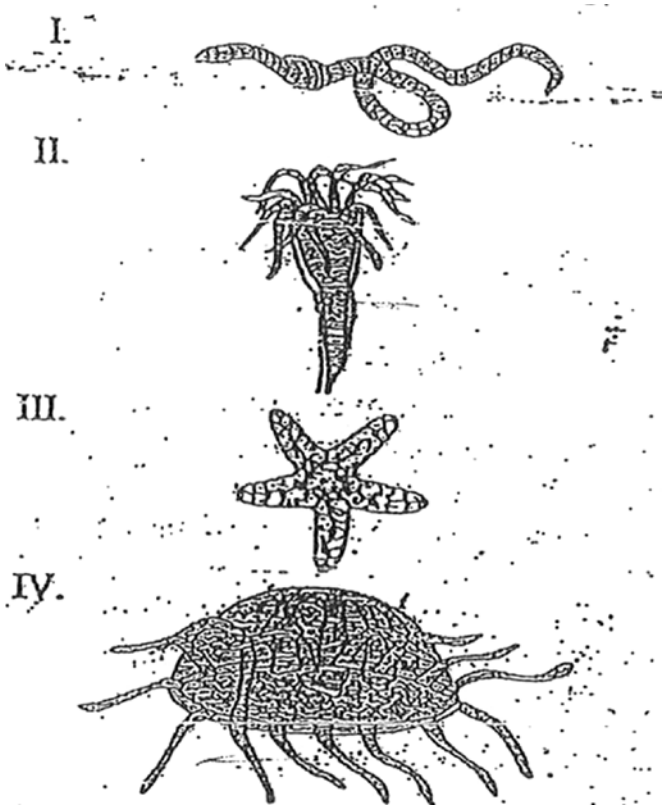
(A) Mutation
(B) Sexual reproduction
(C) Mitosis
(D) Random combination of gametes in fertilization
(E) Natural selection

33. Which of the following statements about the human female reproductive system is true?
(A) The monthly onset of menstruation coincides with ovulation
(B) Two eggs are normally released from the ovaries each month, one from each ovary
(C) Fertilization of the egg normally occurs in the fallopian tube (oviduct)
(D) The vaginal lining breaks down once a month
(E) The unfertilized egg is capable of embedding in the uterine wall

34. All biological oxidation-reduction reactions necessarily involve the transfer of

(A) Amino acids
(B) Electrons
(C) Ions
(D) Oxygen
(E) Carbon

35. In the illustration below, animals with one opening to the digestive tract and two layers of tissues include which of the following?




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

36. A tree stands 6 meters high and 0.20 meter in diameter. A branch falls leaving a scar that is 0.90 meter above the ground. In 20 years if the tree is 36 meters high, that scar will be how far from the ground?

(A) 18.00 meters
(B) 12.00 meters
(C) 7.20 meters
(D) 6.00 meters
(E) 0.90 meters

37. Which of the following organisms do NOT belong to the kingdom Plantae?

(A) Coniferous trees
(B) Fungi
(C) Angiosperms
(D) Mosses
(E) Liverworts

38. The most dangerous aspect of the use of the pesticide DDT is that it

(A) Kills plants as well as insects
(B) Accumulates in higher trophic levels
(C) Leaches nitrogen from the soil
(D) Depletes the ozone layer
(E) Can be used as food by harmful bacteria

39. The similarities between the wings of insects and bats exemplify which of the following?

(A) Adaptive radiation
(B) Convergent evolution
(C) Homology
(D) Recapitulation
(E) Succession

40. Which of the following substances has the greatest amount of the energy per gram?

(A) Starch
(B) Alanine
(C) Cellulose
(D) Vitamin C
(E) Fat

41. In humans, colour-blindness is a recessive sex-linked trait. A woman with normal colour vision, whose father was colour-blind, marries a man with normal colour vision. What % of their sons will probably be colour-blind?

(A) 0%
(B) 25%
(C) 50%
(D) 75%
(E) 100%

42. All of the following properties are characteristics of messenger RNA EXCEPT:

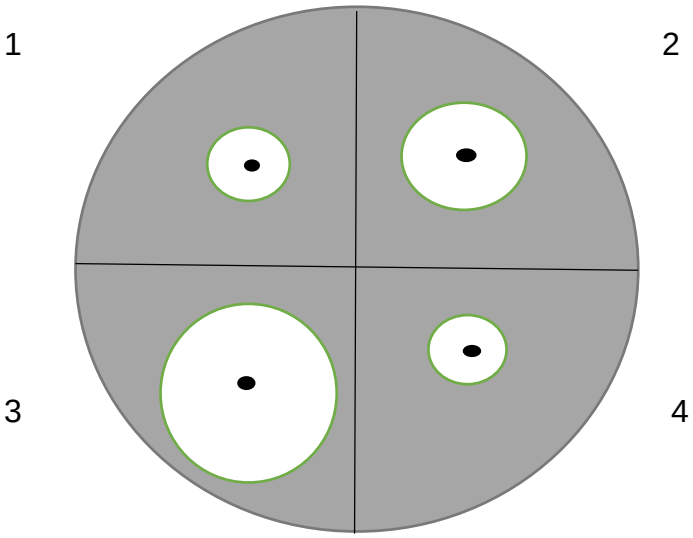
(A) It receives genetic information from DNA
(B) It consists of two nucleotide chains
(C) It is found in both the nucleus and the cytoplasm of the cell
(D) It determines the order of the amino acids in a protein molecule
(E) It binds temporarily to transfer RNA during protein synthesis

43. The flat, thin shape typical of most leaves is advantageous to the plant because it

(A) Makes leaves less obvious to predators
(B) Enables plants to lose a lot of water through transpiration
(C) Delays leaf drop in the autumn
(D) Provides maximum surface area for photosynthesis
(E) Provides maximum shades for the roots and stem

Questions 44-46

The results of an experiment comparing the effects of four antibiotics on the growth of a strain of bacteria are shown below. The bacteria were grown on nutrient agar. The amount of antibiotics is shown is the same on each paper disc. The diagram shows the results after one day. The areas of no growth are white




Quadrant 1 – paper disk with streptomycin

Quadrant 2 – paper disk with Erythromycin

Quadrant 3 – paper disk with Tetracycline

Quadrant 4- paper disk with Penicillin

44. Based on the results of the experiment, the best treatment to eliminate an infection with this strain of bacteria would be

(A) Penicillin
(B) Tetracycline
(C) Streptomycin only
(D) Erythromycin only
(E) Erythromycin and streptomycin

45. The plate was examined the following day and small colonies were observed within the white area of the penicillin treatment. Which of the following is the best explanation for this new growth?

(A) The strain of bacteria grows well on all types of media
(B) Penicillin is an ineffective antibiotic
(C) Penicillin resistance is present in all bacteria strains
(D) The strain of bacteria contained plasmids that promote growth in the presence of all antibiotics
(E) The new colonies represent bacteria with penicillin resistance

46. Which of the following in a petri dish would be the most appropriate control for this experiment?

(A) No antibiotics, no bacteria, and no agar
(B) A mixture of other antibiotics on paper disks on nutrient agar
(C) Antibiotics, but no bacteria on different nutrient agar
(D) Bacteria and a disk with no antibiotic on the same plate
(E) Bacteria placed in the dark on the same nutrient agar

Questions 47-50 refer to the following information

A student placed some fresh carrots in several different containers on the kitchen counter and examined them weekly. The following observations were recorded

| **Container type** | **Conditions of carrots** | | |
|---|---|---|---|
| | Week 1 | Week 2 | Week 3 |
| **Black paper bag** | Firm | Slightly flexible | Very flexible |
| **Black plastic bag** | Firm | Firm | Slightly flexible |
| **Clear plastic bag** | Firm | Firm | Slightly flexible |
| **Uncovered bowl** | Firm | Slightly flexible | Very flexible |
| **Bowl with water** | Firm | Firm | Firm |

47. The experiment data shows

(A) Carrots in paper bags become flexible more rapidly than carrots in plastic bags
(B) Carrots in plastic bags become flexible more rapidly than carrots in paper bags
(C) Carrots in water become more flexible in three weeks than carrots in black paper bags
(D) Contact with plastic keeps carrots firm
(E) Carrots become flexible no matter how they are stored.

48 The best way to determine whether light has an effect on carrot fitness is to compare the effects of storing carrots in a

(A) Paper bag at room temperature versus in a refrigerator
(B) Paper bag versus uncovered bag
(C) Black paper bag versus a black plastic bag
(D) Black plastic bag versus clear plastic bag
(E) Black paper bag versus clear plastic bag

49 The best explanation of why some carrots in the experiment became flexible is that
(A) Carrot cells contract when in contact with container surface
(B) Carrots without leaves cannot obtain energy from photosynthesis
(C) Water evaporation causes carrot cell membranes to shrink away from cell walls
(D) Water evaporation causes carrot cells to stop protein synthesis
(E) Water evaporation causes carrot cell walls to expand

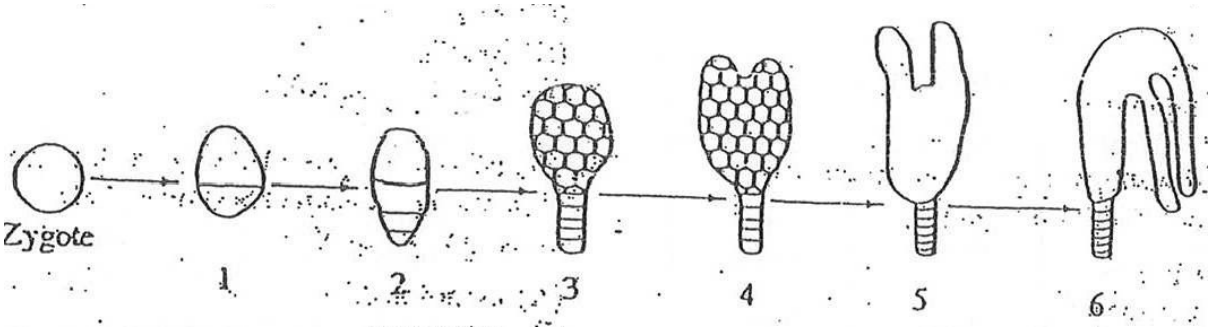
50. The student then took two new samples of carrots, placed them both in black plastic bags, and stored one bag on a countertop and one bag in the refrigerator. At the end of the 3 weeks, the carrots on the countertop had sprouted and the carrots in the refrigerator had not. These results can be best explained by which of the following?

(A) The carrots on the countertop had a higher metabolic rate
(B) The carrots on the countertop were exposed to more light than the ones in the refrigerator
(C) The carrots on the countertop had slower cell respiration than the ones in the refrigerator
(D) Darkness speeds up the process of cell division
(E) The cold has little effect on the sprouting of carrots

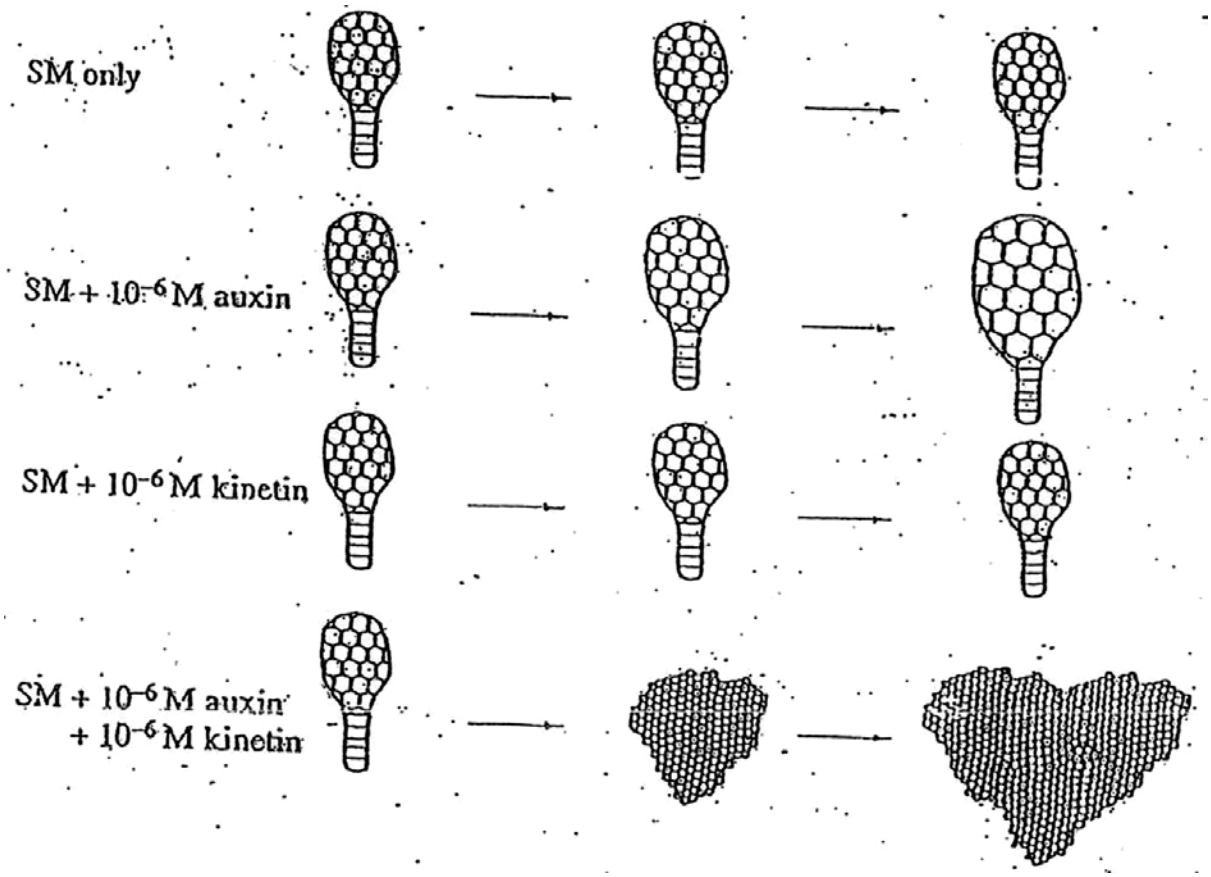
Questions 51-54

A class studied the development of embryo of Capsella by removing embryos from fruits in various stages of development. The normal developmental stages they observed are illustrated below.

STAGES OF NORMAL DEVELOPMENT




After the normal developmental sequence was established, the class decided that stage 3 embryos would be removed and cultured in various media. The standard medium, SM, contains water, salts, sugars, amino acids, and vitamins. The standard medium was supplemented in some cultures with hormones called auxin and kinetin. Five embryos were cultured in each medium. The development of these cultured embryos is shown below.



51. In the normal developmental sequence, the transition between the zygote and embryonic stage 1 is most likely the result of which of the following processes?

(A) Budding
(B) Fragmentation
(C) Differentiation
(D) Mitotic cell division
(E) Meiotic cell division

52. The SM medium supplemented with auxin alone stimulated which of the following?

I. Cell division
II. Cell enlargement
III. Cell differentiation

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

53. The pattern of cell division seen in embryos cultured in SM medium with added auxin and kinetin is most like which of the following human disease?

(A) Cancer
(B) Sickle cell anemia
(C) Acne
(D) Malaria
(E) The common cold

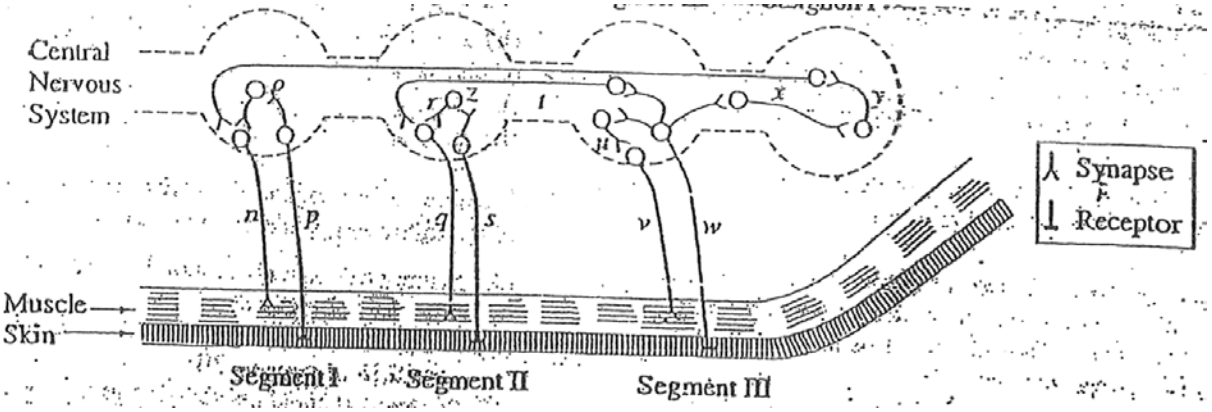
54. The information provided suggests that the organism being studied best fits into the taxonomic group of

(A) Cyanobacteria
(B) Green algae
(C) Fungi
(D) Mosses
(E) Flowering plants

Questions 55-58

The diagram below show a terminal (end) portion of the nervous system of a segmented earthworm. The cell bodies of the neurons are arranged in groups, each of which is called a ganglion.

Ganglion I Ganglion II Ganglion III Ganglion IV



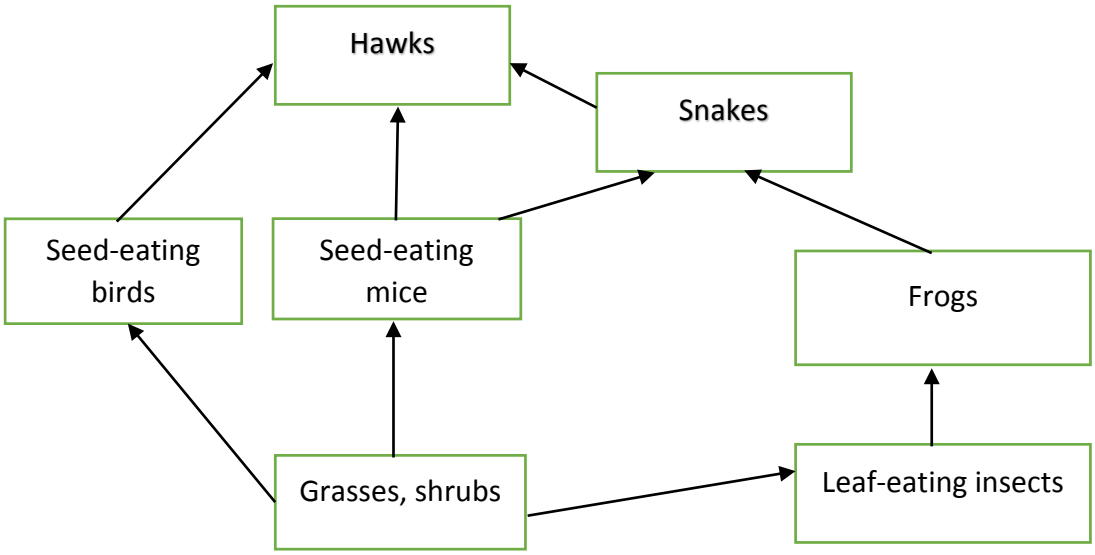
55. What effect would the destruction of neuron n have on earth worm?
A. The skin at segment I would not receive stimulation
B. The muscular movements at only segment I would be stopped
C. The muscular movements at segment II as well as those at segment I would be stopped
D. Neuron p would deteriorate
E. Neuron z would deteriorate

56. If the worm is touched at segment III, the muscles in that segment contract. Which of the following are the only neurons that must be involved in this stimulus-response action?
(A) q ,r ,s
(B) q, t, w
(C) w, u , v
(D) n, z, y, x, w
(E) s, r, t, u, v

57. if the worm is touched at segment III and the muscles in segment II respond, which of the following neurons must be involved in the segment II response?
(A) s, r, q
(B) s, t, v
(C) w, u, v
(D) w, t, q
(E) q, t, n
58. if neuron y in ganglion IV were destroyed, which of the following would be the result?

(A) Segment I could not respond to a stimulus at the skin of segment I
(B) Segment I could not respond to a stimulus at the skin of segment III
(C) Segment II could not respond to a stimulus at the skin of segment II
(D) Segment II could not respond to a stimulus at the skin of segment III
(E) Segment III could not respond to a stimulus at the skin of segment III

Questions 59-60 refer to the following deciduous forest food web




59. Within the food web, which of the following would be considered tertiary consumers?

A. Leaf-eating insects
B. Frogs
C. Seed-eating mice
D. Seed-eating birds
E. Hawks

60. In an ecological context, the trophic level with the greatest amount of energy is represented by which of the following organisms?
A. Grasses
B. Hawks
C. Seed-eating mice
D. Seed-eating birds
E. Leaf-eating insects

**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 SECTION

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. Based on ecological principles, the planet Earth could support the largest number of people if they ate primarily

A. Cereals, fruit, and vegetables
B. Beef, pork, and lamb
C. Milk and milk products
D. Fish
E. Poultry

62. Bacteria that live in the root nodules of clover are most important in the continuation of the

A. Carbon cycle.
B. Phosphorous cycle
C. Water cycle
D. Nitrogen cycle
E. Sulfur cycle

63. According to current scientific thinking, which of the following was probably NOT abundant in the atmosphere at the time that life first appeared on Earth?

A. Hydrogen gas
B. Ammonia gas
C. Water vapour
D. Methane gas
E. Oxygen gas

64. Which of the following correctly orders the levels of organization from simplest to most complex

A. Community-ecosystem-biosphere-population
B. Community-population-biosphere-ecosystem
C. Population-community-biosphere-ecosystem
D. Ecosystem-community-population-biosphere
E. Population-community-ecosystem-biosphere

65. Numerous strains of mosquitos now exist that can tolerate formerly lethal doses of the insecticide DDT. The most reasonable explanation for this decreased effectiveness of DDT is that

A. The mosquitos produced antibodies to DDT
B. Mosquitos that were resistant to DDT survived and reproduced
C. DDT decays over time
D. DDT failed to interfere with the synthesis of messenger RNA
E. DDT enhanced larvae development in the mosquitos

66. Which of the following best describes the behaviour displayed by domestic cats that run into the kitchen on hearing the sound of a can opener?

A. Habituation
B. Imprinting
C. Problem-solving
D. Conditioning
E. Instinct

67. Many years ago a group of islands off the coast of South America were colonized by a single species of finch from the mainland. Each island now is inhabited by a different species of finch, all of which are descendants of the original colonizing species. This is an example of

A. Convergent evolution
B. Adaptive radiation
C. Symbiosis
D. Succession
E. Continental drift

68. Characteristics of tropical rain forests include all of the following EXCEPT

A. Extreme temperature fluctuations
B. High humidity
C. Diverse animal life
D. Nutrient-poor soil
E. A great variety of tall trees

69. A person exposed to the heart of the desert undergoes certain changes in bodily function that results in cooling of the body. Which of the following would be the most likely change?

A. Increased blood circulation in the skin
B. Increased erection of hairs (goose bumps)
C. Increased muscular activity
D. Decreased sweating
E. Decreased hear loss from the capillary beds of the skin

70. Some species have shown little evolutionary change for very long periods of time. The best explanation for the apparent lack of change is that the species

A. Has been purged of harmful genes by inbreeding
B. Is not capable of genetic variation
C. Consists of members that are genetically homozygous recessive for many traits
D. Has DNA that resists mutations
E. Exists in an environmental niche that has remained relatively stable

Questions 71-73

Two species of flies were collected in the wild, then maintained in small cages- one containing species X, one containing species Y, and one containing species X and species Y, the cages were regularly provided with food, the same amounts of food were added to each cage. The growth of these populations is shown in figures 1 to 3 below.

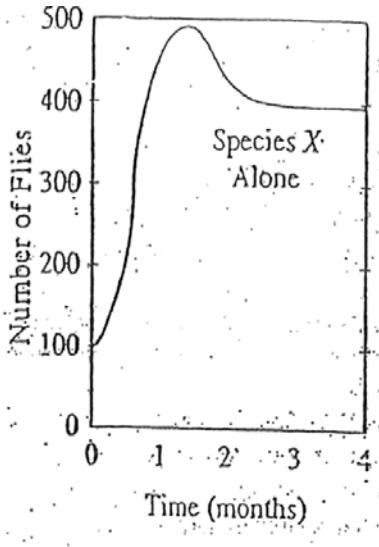


Figure 1

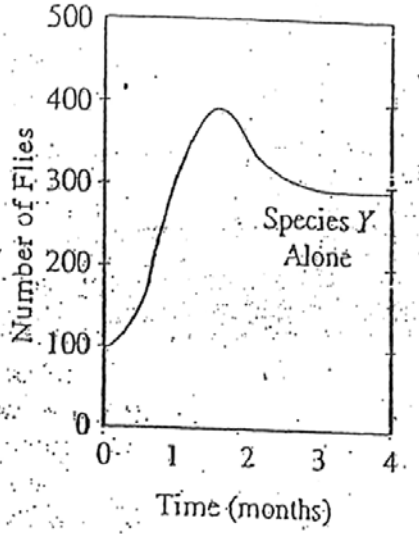


Figure 2

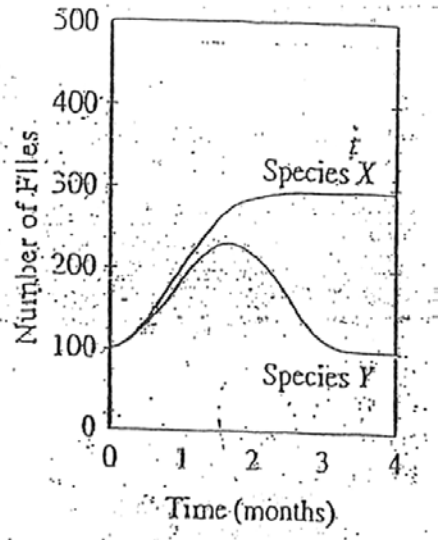


Figure 3

71. What is the carrying capacity of the small-cage environment for species when grown alone?

(A) 100 flies
(B) 200 flies
(C) 300 flies
(D) 400 flies
(E) 500 flies

72. Which of the following conclusions is best supported by this data?

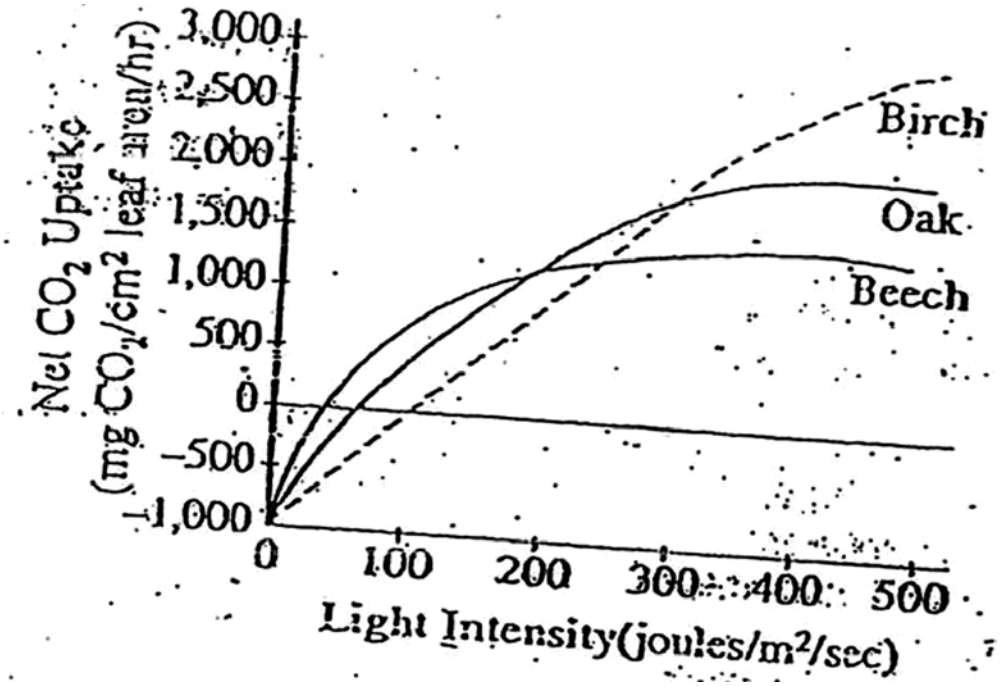
(A) Species X and species Y grow independently of each other.
(B) Species X is a predator to species Y
(C) Species X has a higher metabolic rate than species Y
(D) Species X competes better than species Y in the environment
(E) Species X reproduces more slowly than species Y

73. If the culture in figure 3 were started with 200 flies of each species instead of 100 as shown, how would the equilibrium population sizes be predicted to compare with the equilibrium population sizes shown in figure 3?

(A) The equilibrium sizes of both populations would be doubled
(B) The equilibrium sizes of both populations would be changed
(C) The population size of species Y would be doubled, but the population size of species X would level off at 400 flies
(D) The total number of flies will be doubled, but the number of each species could not be predicted
(E) Both populations would die out due to increased competition

Questions 74-78

In a study of ecological succession, an ecologist measured the rates of photosynthesis of seedlings of three tree species in pots in the laboratory at various light levels. These results are shown in the graph below. Fields study of succession shows that birch trees tended to colonize open area first. The resulting birch forests tended to be replaced by oak forests, and oak forests tended to be replaced by beech forests.




74. At very low light levels, all species show a net loss of $CO_2$ because
A. Leaves are shed
B. Respiratory reactions are reversed
C. Nitrogen limits plant growth
D. Respiratory losses exceed photosynthetic gain
E. Stomates are closed

75. At which of the following intensities does oak have a higher net rate of $CO_2$ uptake than do either of the other two species

(A) 0 joules/$m^2$/sec
(B) 50 joules/$m^2$/sec
(C) 100 joules/$m^2$/sec
(D) 250 joules/$m^2$/sec
(E) 350 joules/$m^2$/sec

76. A birch seedling with three leaves, all of the same size, was exposed to 200 joules/$m^2$/sec of light, the loss or gain of CO2 by this plant in one hour is closest to which of the following?

(A) 0 mg/$cm^2$ leaf area
(B) 500 mg/$cm^2$ leaf area
(C) 1,000 mg/$cm^2$ leaf area
(D) 2,000 mg/$cm^2$ leaf area
(E) 3,000 mg/$cm^2$ leaf area

77. Which statement about succession is best supported by comparing the data for these species?

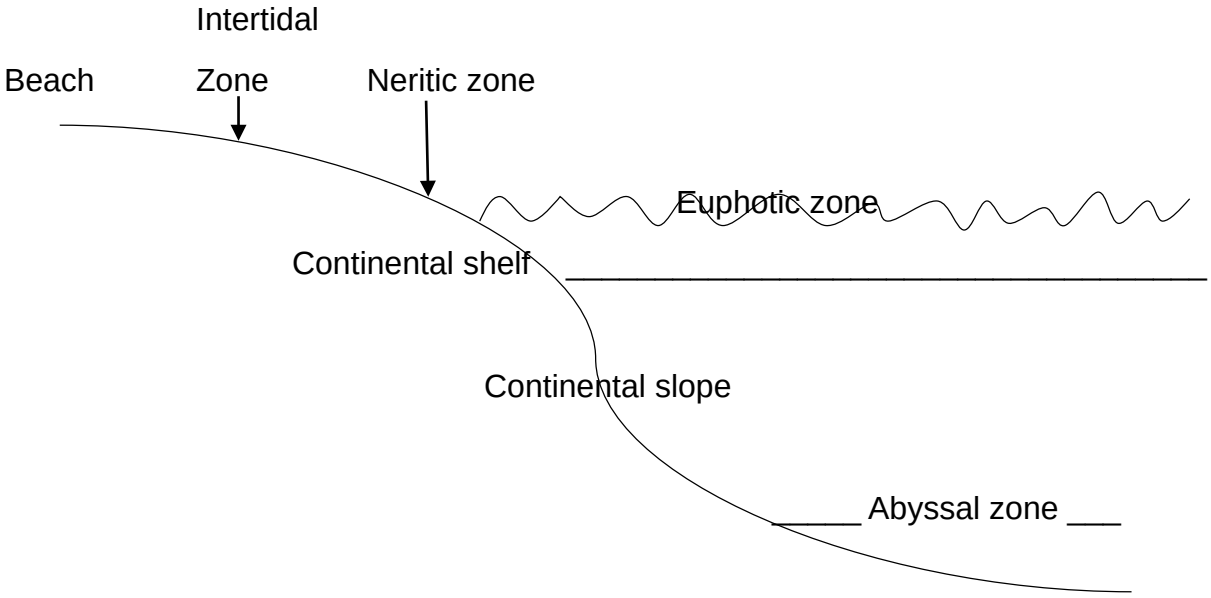
(A) Late succession species have higher maximum rate of photosynthesis
(B) Late succession species are better able to photosynthesize in shade
(C) Late succession species are limited by nitrogen
(D) Late succession species produce more seeds
(E) Early succession species cast deeper shade

78. All of the following are necessary for obtaining reliable data from this experiment EXCEPT

(A) Holding temperature constant in the laboratory
(B) Keeping
(C) Trimming the leaves so each plant has the same leaf area
(D) Keeping the soil equally moist in each pot
(E) Using plants that are free of disease

Questions 79-80

THE MAJOR ZONES OF THE OCEAN




79. For the ocean ecosystem shown above, the LEAST primary productivity occurs in:

(A) Abyssal zone
(B) Neritic zone
(C) Euphotic zone
(D) Continental shelf
(E) Continental slope

80. Adaptations necessary for survival of organisms in the abyssal zone include which of the following?

I. Tolerance of low temperature
II. Tolerance of high pressure
III. Requirements for high light intensity

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

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. An unidentified liquid is isolated from a sample of ground up bean-seeds, when the liquid is added to a test tube of water and shaken vigorously, the water and the unknown liquid separate into two layers after a few minutes, to which class of biological macromolecules should the unknown liquid most likely be assigned to:

A. Carbohydrates
B. Enzymes
C. Liquids
D. Nucleic acids
E. Proteins

82. The rate of exchange of nutrients and water between a living eukaryote cell and its environment is a function of which of the following properties?

A. The ratio of surface area to volume of the cell
B. The number of chromosomes
C. The rate of DNA transcription
D. The mass of the cell
E. The number of organelles in the cell

83. All of the following cellular structures include membranes EXCEPT:

A. Nucleolus
B. Nuclear envelope
C. Endoplasmic reticulum
D. Mitochondrion
E. Chloroplasts

84. The secondary and tertiary structures of protein molecule are ultimately due to which of the following?

A. The length of mRNA molecule being transcribed
B. A group of cells specialized to alter protein shape
C. A special cellular organelle that fits a protein to its function
D. The primary structure (amino acid order) of protein molecule
E. Ionic bonds within the specific amino acid tryptophan

85. What final product of photosynthesis is an initial reactant in glycolysis?

A. NADP
B. $CO_2$
C. $C_6H_{12}O_6$
D. ATP
E. $O_2$

86. A man and woman neither of whom has cystic fibrosis, are the biological parents of two children who do have the disorder. What is the probability that the next child of these parents will have cystic fibrosis?

A. 100%
B. 75%
C. 50%
D. 25%
E. 0%

87. Vitamins are essential in the diet of an animal because they directly affect reactions that require

A. Haemoglobin
B. Coenzymes
C. Nucleic acids
D. Bile
E. Antibodies

88. In animals, gametes result from which of the following processes?

A. Cleavage
B. Meiosis
C. Fertilization
D. Parthenogenesis
E. Respiration

89. In fruit flies, white eyes are recessive, sex-linked trait. If a red-eyed female fruit fly mated to a white-eyed male, their F1 offspring may be which of the following?

I. 50% red-eyed, 50% white-eyed for both sexes
II. 50% red-eyed males, 50% white-eyed males, all red-eyed females
III. 100% red-eyed for both sexes
IV. 100% white-eyed males, 100% red-eyed females

A. I only
B. II only
C. III only
D. IV only
E. I and III only

90. Which of the following is an example of a Mendelian testcross to determine the genotype of an individual?

A. AA x Aa
B. Aa x Aa
C. Aa x aa
D. AaBB x AaBB
E. AaBb x AaBb

91. A cytologist studying onion cells notes that after 12 hours, the amount of DNA in a cell has doubled. Which of the following is the best explanation for this observation?

A. Nucleotides have diffused into the cell against the concentration gradient
B. Metaphase has begun, concentrating chromosomes in the center of the cell
C. Protein synthesis has stopped, resulting in an overproduction of DNA
D. New plasma membranes have been formed during cytokinesis
E. The S phase of the cell cycle has occurred

92. Which of the following karyotypes would be typical for a human female?

I. XX
II. XY
III. XO

A. I only
B. II only
C. III only
D. I and II
E. I and III

93. The fluid surrounding human blood cells contains fewer potassium ions (K+) than sodium ions (Na+). Yet the cytoplasm of blood cells contains more K+ than Na+, the most likely reason for this difference is that

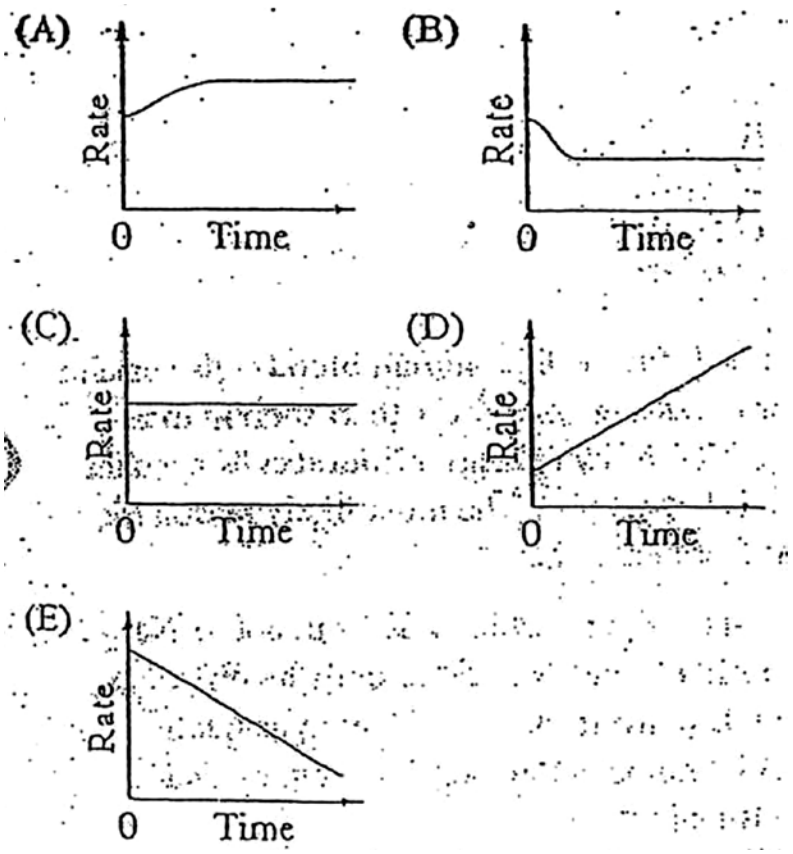
A. Cells are permeable to K+ but not Na+
B. Both K+ and Na+ enter cells by diffusion
C. Cells convert Na+ to K+ enzymatically
D. Cells pump K+ in and Na+ out by active transport
E. K+ crystallizes inside cells and cannot diffuse out

Questions 94-98

Observations of the respiration rate of pea seedlings at different temperatures over time produced the following. The rates are given as a percentage of the rate at 25ºC

| Temperature | 0 hr | 1 hr | 2 hr | 3 hr | 4 hr | 5 hr | 6 hr | 7 hr | 8 hr |
|---|---|---|---|---|---|---|---|---|---|
| 0 ºC | 100% | 50% | 40 % | 10 % | 10 % | 10 % | 10 % | 10 % | 10 % |
| 10 ºC | 100 | 75 | 60 | 40 | 40 | 40 | 40 | 40 | 40 |
| 25 ºC | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |
| 30 ºC | 100 | 110 | 130 | 140 | 140 | 140 | 140 | 140 | 140 |
| 40 ºC | 100 | 130 | 140 | 170 | 160 | 150 | 140 | 130 | 120 |
| 50 ºC | 100 | 98 | 96 | 94 | 70 | 45 | 30 | 15 | 0 |

94. If the rate at 30 ºC is plotted against time, a graph of the results would look like which of the following?



95. If a reading were taken at 7.5 hours at 40ºC, the rate most likely would be

A. 110%
B. 120%
C. 125%
D. 130%
E. 135%

96. The control temperature in the experiment is
A. 0ºC
B. 10ºC
C. 25ºC
D. 40ºC
E. 50ºC

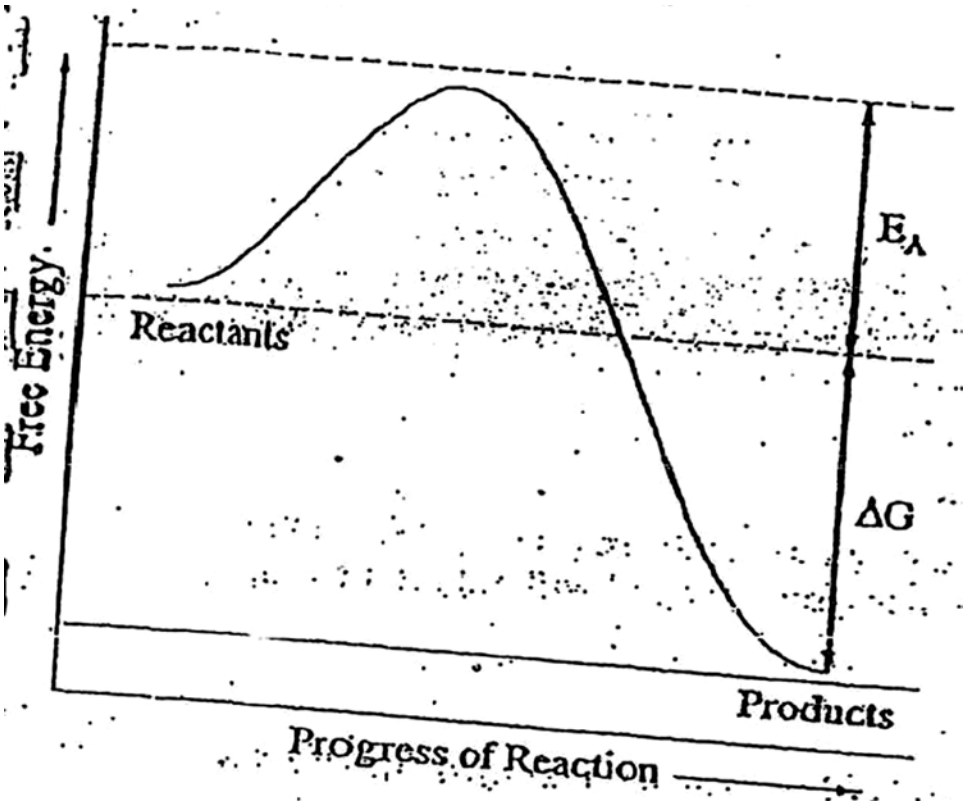
97. According to the data, a pea seedling is most likely to die in 8 hours at which of the following temperatures?

A. 0ºC
B. 10ºC
C. 25ºC
D. 40ºC
E. 50ºC

98. Based on the data, the best explanation for the respiration rate after 3 hours at 0ºC is that
A. Enzymes hydrolyze at low temperatures
B. Low temperatures slow down reaction rates
C. Enzymes are not affected by temperature changes
D. Enzymes are used up within 3 hours
E. Enzymes are inactivated by the changes in pH that occur at 0ºC

Questions 99-100

The following graph shows an energy profile of a reaction. $E_A$ is the activation energy to reach an unstable transition state and $\Delta G$ is the difference in free energy of products and reactants for the overall reaction




99. The activation energy ($E_A$) of the reaction is the energy required
   A. To form substrates in the reaction
   B. To change tertiary enzymes structure
   C. To change the bonds between reactant molecules
   D. To bring reactants together in solution
   E. To allow products to reach a stable state

100. Enzymes change the rate of reaction by
   A. Lowering the $E_A$ of the reaction
   B. Lowering the $\Delta G$ of the reaction
   C. Raising the $E_A$ of the reaction
   D. Raising the $\Delta G$ of the reaction
   E. Changing the form of the transition state

Answers:

## Test; Characteristic:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 1. | C | 16. | E | 31. | B | 46. | D |
| 2. | E | 17. | E | 32. | A | 47. | A |
| 3. | A | 18. | A | 33. | C | 48. | D |
| 4. | E | 19. | A | 34. | B | 49. | C |
| 5. | A | 20. | A | 35. | D | 50. | A |
| 6. | E | 21. | C | 36. | E | 51. | D |
| 7. | A | 22. | D | 37. | B | 52. | B |
| 8. | B | 23. | B | 38. | B | 53. | A |
| 9. | C | 24. | A | 39. | B | 54. | E |
| 10. | C | 25. | B | 40. | E | 55. | B |
| 11. | D | 26. | B | 41. | C | 56. | C |
| 12. | A | 27. | D | 42. | B | 57. | D |
| 13. | E | 28. | D | 43. | D | 58. | B |
| 14. | A | 29. | D | 44. | B | 59. | E |
| 15. | C | 30. | D | 45. | E | 60. | A |

## E-Section:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 61. | A | 66. | D | 71. | D | 76. | C |
| 62. | D | 67. | B | 72. | D | 77. | B |
| 63. | E | 68. | A | 73. | B | 78. | B |
| 64. | E | 69. | A | 74. | D* | 79. | A |
| 65. | B | 70. | E | 75. | D | 80. | C |

* The Answer Is Not Confirmed.

## M-Section:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 81. | C | 86. | D | 91. | E | 96. | C |
| 82. | A | 87. | B | 92. | A | 97. | E |
| 83. | A | 88. | B | 93. | D | 98. | B |
| 84. | C | 89. | E | 94. | A | 99. | D |
| 85. | C | 90. | C | 95. | C | 100. | A |