

AP BIOLOGY PRETEST EXAM

1. Which of the following is an example of a hydrogen bond?

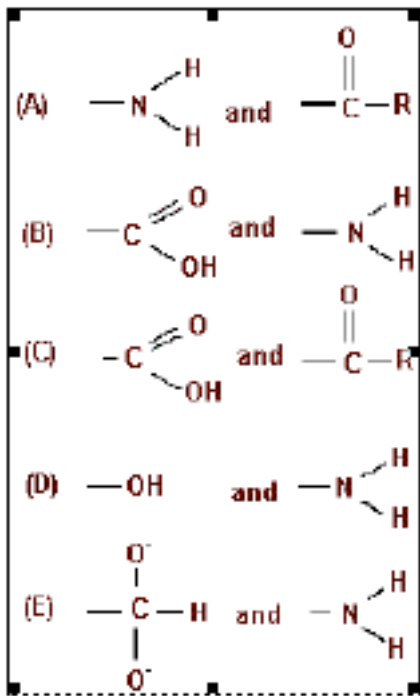
- A) The peptide bond between amino acids in a protein
- B) The bond between an oxygen atom and a hydrogen atom in the carboxyl group of a fatty acid
- C) The bond between  $\text{Na}^+$  and  $\text{Cl}^-$  in salt
- D) The attraction between a hydrogen of one water molecule and the oxygen of another water molecule
- E) The bond between carbon and hydrogen in methane

2.  $A + B + \text{energy} \rightarrow AB$

Which of the following best characterizes the reaction represented above?

- A) Hydrolysis
- B) Catabolism
- C) Oxidation-reduction
- D) Exergonic reaction
- E) Endergonic reaction

3. Which of the following pairs of functional groups characterizes the structure of an amino acid?



- A) A
- B) B
- C) C
- D) D
- E) E

4. All of the following are typical components of the plasma membrane of a eukaryotic cell EXCEPT

- A) glycoproteins
- B) nucleic acids
- C) cholesterol
- D) phospholipids
- E) proteins

**Questions 5. - 8. refer to the following groups of biological compounds.**

- (A) Proteins
- (B) Carbohydrates
- (C) Nucleic acids
- (D) Lipids
- (E) Steroids

5. Synthesized at the ribosome

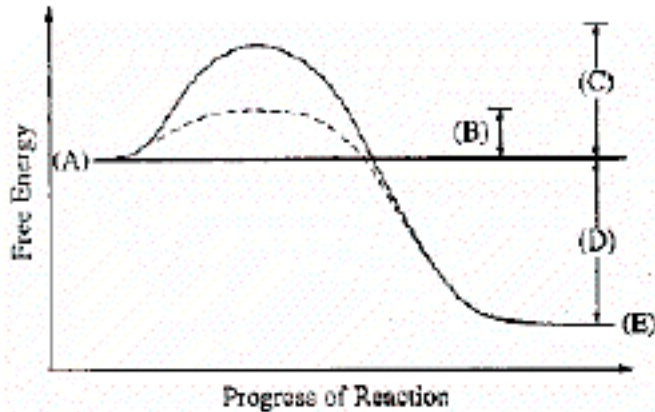
6. Includes glycogen, chitin, cellulose, and glucose

7. Stored in adipose tissue

8. Used to carry the genetic code

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. Each heading may be used more than once, or not at all in each group.

Questions 9. - 11.: The solid curve and the dashed curve represent alternate pathways for the same reaction. One pathway is enzyme catalyzed.

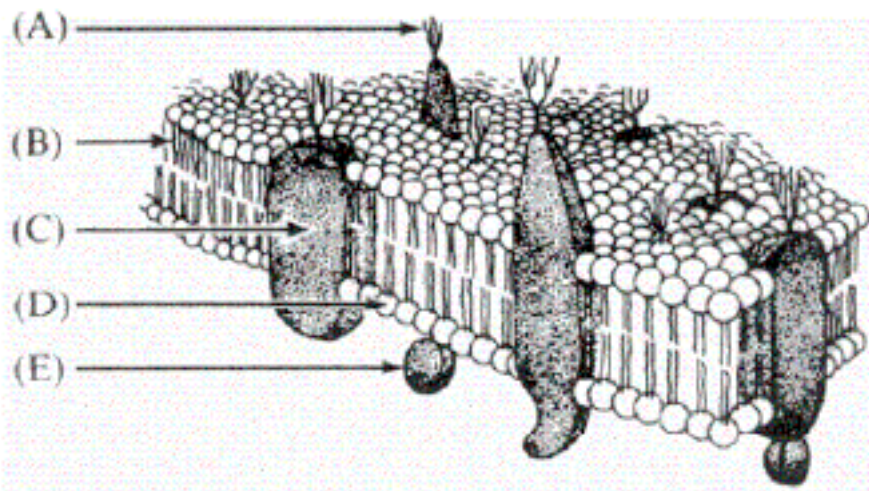


9. Represents the activation energy of the enzyme-catalyzed reaction
  10. Represents the energy state of the products of the enzyme-catalyzed pathway
  11. Represents the activation energy needed if there are no enzymes
12. One of the most pronounced differences between animal and plant cells is that
    - A) animal cells alone have one or more large vacuoles
    - B) animal cells alone have a nucleolus
    - C) animal cells alone have their nuclear chromatin attached to the spindle fibers during mitosis
    - D) plant cells alone have rough endoplasmic reticulum
    - E) plant cells alone have relatively thick, rigid cell walls
  13. The organelle that is a major producer of ATP and is found in both heterotrophs and autotrophs is the
    - A) chloroplast
    - B) nucleus
    - C) ribosome
    - D) Golgi apparatus
    - E) mitochondrion
  14. All of the following cell components are found in prokaryotic cells EXCEPT
    - A) DNA
    - B) ribosomes
    - C) cell membrane
    - D) nuclear envelope
    - E) enzymes

15. If plant cells are immersed in distilled water, the resulting movement of water into the cells is called
- conduction
  - active transport
  - transpiration
  - osmosis
  - facilitated diffusion
16. Which of the following is the primary role of the lysosome?
- ATP synthesis
  - Intracellular digestion
  - Lipid transport
  - Carbohydrate storage
  - Protein synthesis
17. Which of the following cellular processes is coupled with the hydrolysis of ATP?
- Facilitated diffusion
  - Active transport
  - Chemiosmosis
  - Osmosis
  - Na<sup>+</sup> influx into a nerve cell

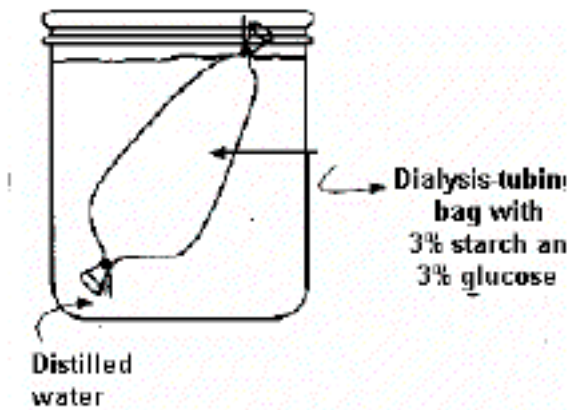
**Directions:** Each group of questions below consists of five lettered headings followed a list of numbered phrases or sentences. For each numbered phrase or sentence, select the one heading to which it is most closely related and fill in the corresponding oval on the answer sheet. Each heading may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

Questions 18. - 19. Refer to the diagram of the plasma membrane below.



18. Hydrophilic portion of lipid molecule
19. Carriers involved in cell transport

Questions 20. - 21. Refer to an experiment in which a dialysis-tubing bag is filled with a mixture of 3% starch and 3% glucose and placed in a beaker of distilled water, as shown below. After 3 hours, glucose can be detected in the water outside the dialysis-tubing bag, but starch cannot.



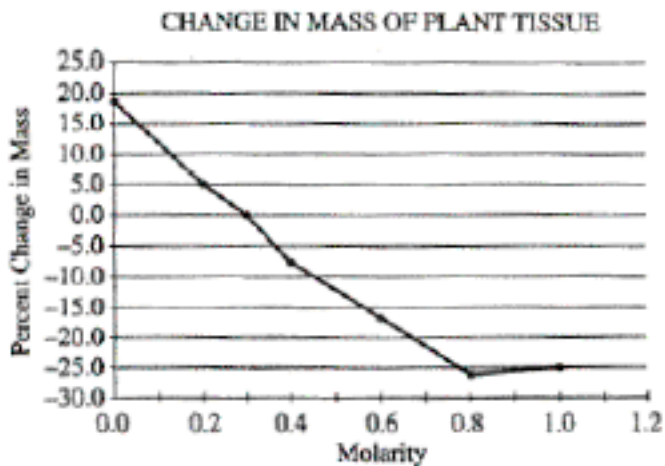
20. From the initial conditions and results described, which of the following is a logical conclusion?

- A. The initial concentration of the glucose in the bag is higher than the initial concentration of starch in the bag.
- B. The pores of the bag are larger than the glucose molecules but smaller than the starch molecules.
- C. The bag is not selectively permeable.
- D. A net movement of water into the beaker has occurred.
- E. The molarity of the solution in the bag and the molarity of the solution in the surrounding beaker are the same.

21. Which of the following best describes the condition expected after 24 hours?

- A. The bag will contain more water than it did in the original condition.
- B. The contents of the bag will have the same osmotic concentration as the surrounding solution.
- C. Water potential in the bag will be greater than water potential in the surrounding solution.
- D. Starch molecules will continue to pass through the bag.
- E. A glucose test on the solution in the bag will be negative.

Questions 22. - 23. Refer to the graph below, which illustrates the percent change in the mass of pieces of plant tissue placed in solutions of different sucrose molarities.



22. Which of the following occurs in the tissue that is placed in 0.6 *M* sucrose?

- (A) The cells become turgid.
- (B) The cells burst.
- (C) The volume of the vacuoles decreases.
- (D) The volume of the cytoplasm increases.
- (E) The cells remain the same as before.

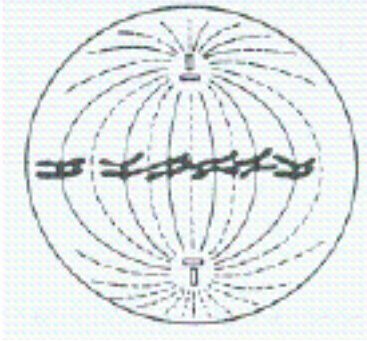
23. The approximate molarity of the solution in which the mass of the plant pieces would not change is

- (A) 0.01 *M*
- (B) 0.1 *M*
- (C) 0.3 *M*
- (D) 0.5 *M*
- (E) 0.7 *M*

24. A human cell in prophase of mitosis can be distinguished from a human cell in prophase I of meiosis by the presence of

- A) kinetochores in the mitotic cell
- B) a spindle in the mitotic cell
- C) twice as many chromosomes in the meiotic cell
- D) half as many chromosomes in the meiotic cell
- E) paired homologous chromosomes in the meiotic cell.

Use the following diagram for questions 25. - 26. It illustrates a dividing cell dividing diploid cell in which the normal chromosome number is 6.



25. This cell is in
- A) prophase of mitosis.
  - B) prophase of the first meiotic division.
  - C) metaphase of mitosis.
  - D) metaphase of the first meiotic division.
  - E) metaphase of the first meiotic division.
26. The number of homologous pairs of chromosomes in the diagram of this cell is
- A) 3
  - B) 6
  - C) 12
  - D) 24
  - E) 36
27. Oxygen consumption can be used as a measure of metabolic rate because oxygen is
- A) necessary for ATP synthesis by oxidative phosphorylation (ETC and chemiosmosis)
  - B) necessary to replenish glycogen levels
  - C) necessary for fermentation to take place
  - D) required by all living organisms
  - E) required to break down the ethanol that is produced in muscles
28. During respiration, most ATP is formed as a direct result of the net movement of
- A) potassium against a concentration gradient
  - B) protons ( $H^+$ ) down a concentration gradient
  - C) electrons against a concentration gradient
  - D) electrons through a channel
  - E) sodium ions into the cell
29. Which metabolic process is common to both aerobic cellular respiration and alcoholic fermentation?
- A) Krebs cycle
  - B) Glycolysis
  - C) Electron transport chain
  - D) Conversion of pyruvic acid to acetyl CoA
  - E) Production of a proton gradient

30. Which of the following directly produces the most ATP per mole of glucose during aerobic cellular respiration?

- A) Glycolysis
- B) Electron transport chain and chemiosmosis
- C) Substrate-level phosphorylation
- D) Kreb's cycle
- E) Alcoholic fermentation

31. When a muscle cell is metabolizing glucose in the complete absence of molecular oxygen all the following substances are produced *except*

- A) NADH
- B) ATP
- C) pyruvic acid.
- D) lactic acid.
- E) acetyl-CoA.

32. The primary role of oxygen in respiration is to

- A) yield energy in the form of ATP as it is passed down the respiratory chain.
- B) act as an acceptor for electrons and hydrogen, forming water.
- C) combine with carbon forming carbon dioxide.
- D) combine with lactic acid to form pyruvic acid.
- E) catalyze glycolysis reactions.

**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 to which it is most closely related and fill in the corresponding oval on the answer sheet. Each heading may be used once, more than once or not at all in each group.

Questions 33. - 35.

- A. Glycolysis
- B. Krebs cycle (citric acid cycle)
- C. Calvin cycle (light-independent or dark reactions of photosynthesis)
- D. Light reactions of photosynthesis
- E. Chemiosmosis

33. Process in which carbon dioxide is released as a by-product of oxidation-reduction reactions

34. Process found in both photosynthesis and cellular respiration

35. Process in which sugar is oxidized to pyruvate (pyruvic acid)



Use the following key for the questions 36. - 38. below. Put any and all answers that apply.

- I. glycolysis
- II. Krebs cycle
- III. electron-transport chain and chemiosmosis

36. Which one of the above requires oxygen directly?

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

37. Which one of the above makes ATP at the substrate level?

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

38.  $H^+$  ions pumped to the outside compartment of the mitochondrion?

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

39. The end products of the light reactions of photosynthesis are

- A) ADP,  $H_2O$ , NADPH
- B) ADP, PGAL, RuBP (RuDP)
- C) ATP,  $CO_2$ ,  $H_2O$
- D) ATP, NADPH,  $O_2$
- E)  $CO_2$ ,  $H^+$ , PGAL

40. The  $O_2$  released during photosynthesis comes from

- A)  $CO_2$
- B)  $H_2O$
- C) NADPH
- D) RuBP (RuDP)
- E)  $C_6H_{12}O_6$

41. Carbohydrate-synthesizing reactions (Calvin cycle) of photosynthesis directly require

- A) light
- B) products of the light reactions
- C) darkness
- D)  $O_2$  and  $H_2O$
- E) chlorophyll and  $CO_2$

42. **GTAGTAGGT**

What would be the sequence of bases of an mRNA molecule that was transcribed from the sequence of DNA bases shown above?

- A) GTAGTAGGT
- B) CAUCAUCCA
- C) UCGUCGUUC
- D) AUGAUGAAU
- E) CATCATCCA

43. 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

44. Which of the following statements concerning a gene is correct?

- A) A gene can code for a specific protein.
- B) A gene can exist in alternate forms called introns.
- C) A gene undergoes crossing-over during DNA replication.
- D) A gene that is very similar in sequence in a human and in a bacterium is probably a recent mutation.
- E) A gene that is expressed in every offspring of every generation is recessive.

45. Refer to the chart below.

<u>mRNA Codons</u>	<u>Amino Acids</u>
AGA	arginine
GGA	glycine
AGC	serine
GCA	alanine
CAG	glutamine

**glycine-serine-glycine**

Which of the following DNA strands will code for the amino acids sequence shown above?

- A) ACTCCTTCT
- B) TCTCCGTCG
- C) CCGTCGACT
- D) CCTCCGTCG
- E) CCTTCGCCT

46. The transcription of DNA to RNA is accomplished by the enzyme

- A) DNA polymerase.
- B) RNA polymerase
- C) DNA ligase.
- D) RNA kinase.
- E) DNA helicase

Questions 47. - 49.

- A. Transcription
- B. Translation
- C. Transformation
- D. Replication
- E. Reverse transcription

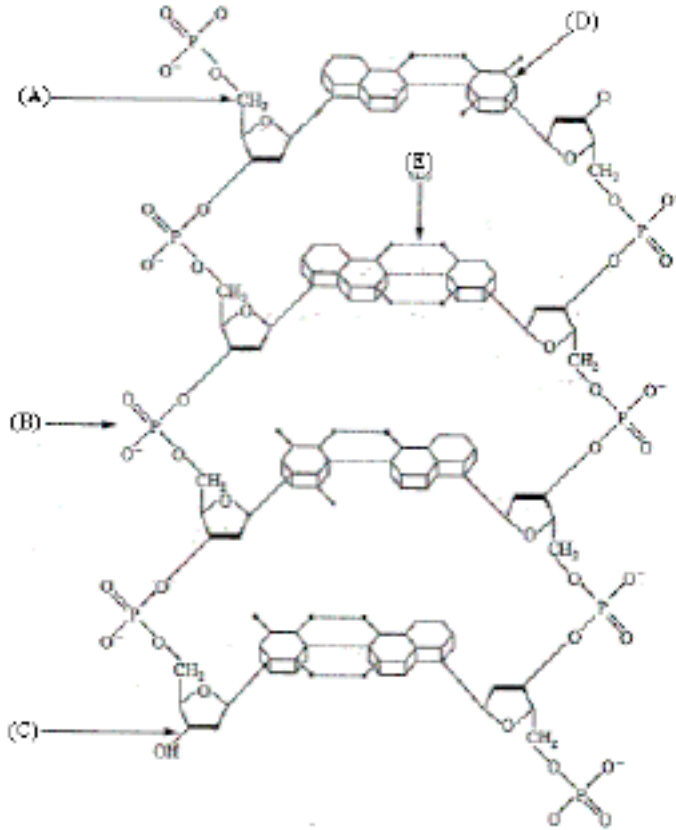
47. Process in which a protein is assembled at a ribosome.

48. Process in which naked DNA is taken up by a bacterial cell.

49. Process in which RNA is produced by using a DNA template.

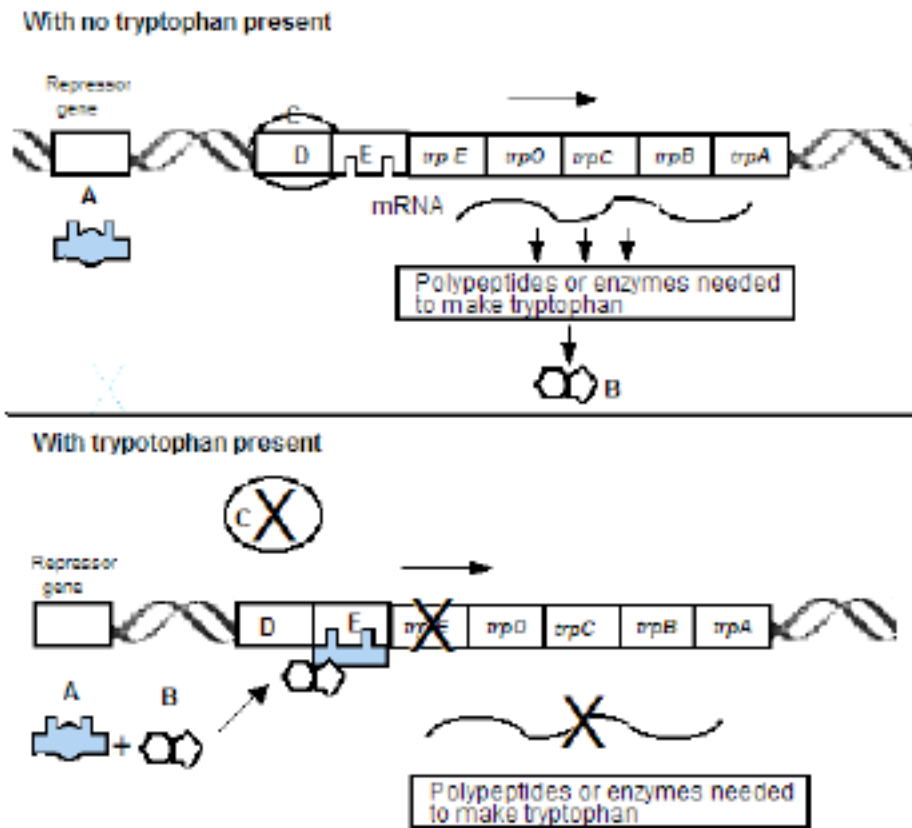
**Directions:** Each group of questions below consists of five lettered headings followed a list of numbered phrases or sentences. For each numbered phrase or sentence, select the one heading to which it is most closely related and fill in the corresponding oval on the answer sheet. Each heading may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

Questions 50. - 53. refer to the following diagram.



50. A chemical group that, together with a sugar and nitrogen base, makes up a nucleotide
51. A hydrogen bond
52. A pyrimidine
53. A 5' carbon of deoxyribose

For questions 54. – 56, refer to this diagram of the *trp* operon.



54. Which structure represents the product of the *trp* operon?

- A) A
- B) B
- C) C
- D) D
- E) E

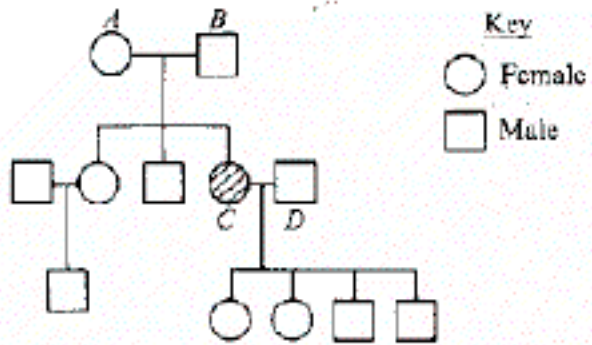
55. Structure A represents

- A) the repressor protein
- B) tryptophan
- C) RNA polymerase
- D) the promoter region
- E) the operator

56. This operon can be classified as

- A) a positive feedback system
- B) an inducible operon
- C) a repressible operon
- D) a reversible operon
- E) an amplified operon

Refer to the following pedigree that illustrates the inheritance of sickle cell anemia. Shading indicates the presence of sickle cell anemia.



57. What is the probability that the next child of parents *A* and *B* would have had sickle cell anemia?
- A) 0%  
 B) 25%  
 C) 60%  
 D) 75%  
 E) 100%

Questions 58. - 60. , refer to the following information.

Achondroplastic dwarfism is a dominant genetic trait that causes severe malformation of the skeleton. Homozygotes for this condition are spontaneously aborted (hence, the homozygous condition is lethal) but heterozygotes will develop to be dwarfed. Matthew has a family history of the condition, although he does not express the trait. Jane is an achondroplastic dwarf. Matthew and Jane are planning a family of several children and want to know the chances of producing a child with achondroplastic dwarfism.

58. The genotypes of Matthew and Jane are best represented as

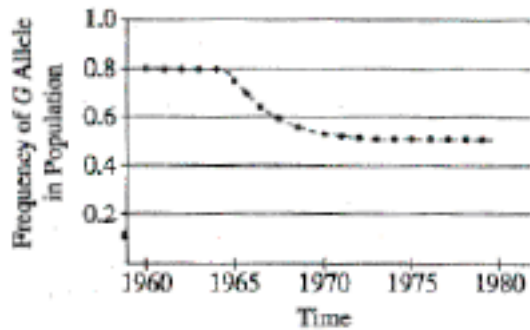
	<u>Matthew</u>	<u>Jane</u>
A)	<i>AA</i>	<i>Aa</i>
B)	<i>Aa</i>	<i>aa</i>
C)	<i>aa</i>	<i>aa</i>
D)	<i>aa</i>	<i>Aa</i>
E)	<i>Aa</i>	<i>Aa</i>

59. The probability that Matthew and Jane's first child will be an achondroplastic dwarf is
- A) 0%  
 B) 25%  
 C) 50%  
 D) 75%  
 E) 100%

60. If three children are born to Matthew and Jane, what are the chances that the first two children will not express the trait but that the third child will be an achondroplastic dwarf?
- A) 5/8  
 B) 4/8  
 C) 3/8  
 D) 1/8  
 E) 1/16

61. In humans, red-green color blindness is a sex-linked recessive trait. If a man and a woman produce a color-blind son, 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.
62. Which of the following statements best describes the effect of genetic drift on the gene frequencies of a population?
- A) Genes enter a population through immigration, thus changing gene frequencies.
  - B) Genes leave a population through emigration, thus changing gene frequencies.
  - C) Chance alone can cause significant changes in gene frequencies of small populations.
  - D) Mutations over time cause gene frequencies to change.
  - E) Selection against one allele causes gene frequencies to change.
63. 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
64. 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 mutants
65. The wing of a bat, the flipper of a whale, and the forelimb of a horse appear very different, yet detailed studies reveal the presence of the same basic bone pattern. These structures are examples of
- A) analogous structures
  - B) homologous structures
  - C) vestigial structures
  - D) balanced polymorphism
  - E) convergent evolution

A moth's color is controlled by two alleles,  $G$  and  $g$ , at a single locus.  $G$  (gray) is dominant to  $g$  (white). A large population of moths was studied, and the frequency of the  $G$  allele in the population over time was documented, as shown in the figure below. In 1980 a random sample of 2,000 pupae was collected and moths were allowed to emerge.



66. Assuming that the population was in Hardy-Weinberg equilibrium for the  $G$  locus, what percentage of moths in the natural population was white in 1962?

- (A) 2%
- (B) 4%
- (C) 8%
- (D) 20%
- (E) 64%



Questions 67. - 68. refer to the chart below that indicates general animal body plans.

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

Note: + indicates presence in an organism.

67. The body plan associated with arthropods is type

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

68. The body plan associated with cnidarians or jellyfish is type

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

69. Which of the following groups contains prokaryotic organisms capable of surviving the greatest extremes in temperature or salt concentration?

- A) Protista
- B) Archaeobacteria
- C) Plantae
- D) Fungi
- E) Viruses

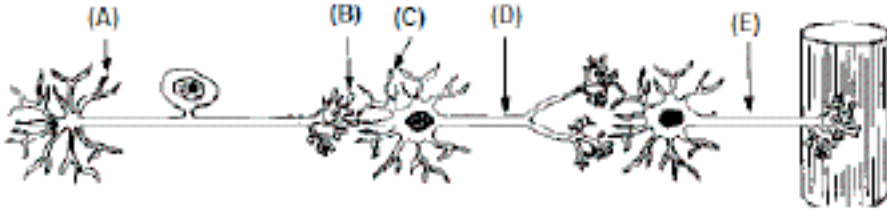
70. Which of the following groups is best characterized as being eukaryotic and heterotrophic and having chitinous cell walls?

- A) Plantae
- B) Animalia
- C) Fungi
- D) Virus
- E) Eubacteria (Monera)

71. The movement of water to the top of a 15-meter tree is **best** explained by
- A) transpiration and cohesion
  - B) root and stem pressure
  - C) barometric pressure
  - D) capillary action
  - E) gravitational flow
72. Compounds that are foreign to an organism and that elicit an immune response in the organism are called
- A) antigens
  - B) interferons
  - C) teratogens
  - D) antibodies
  - E) histamines
73. Cell-mediated immunity is mostly the function of
- A) T cells.
  - B) B cells.
  - C) erythrocytes.
  - D) compliment cells.
  - E) neutropils
74. Which of the following would result if the sodium-potassium pump of a neuron were inoperative?
- A) The movement of chloride ions would produce an action potential.
  - B) An impulse would travel from the axon to the dendrites of the neuron.
  - C) The rate of transmission of the impulse would greatly increase.
  - D) The rate of ATP synthesis would increase.
  - E) An action potential would not occur.
75. Which of the following describes the correct sequence of stages during embryogenesis?
- A) Cleavage, blastula formation, gastrulation
  - B) Cleavage, gastrulation, blastula formation
  - C) Blastula formation, gastrulation, cleavage
  - D) Blastula formation, cleavage, gastrulation
  - E) Gastrulation, cleavage, blastula formation

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

Questions 76. - 78., refer to the diagram below.



76. This structure is a dendrite of a sensory neuron.
77. This structure is an axon of a motor neuron
78. Concentrations of synaptic vesicles containing neurotransmitters are located at this site.
79. Which of the following cell types is responsible for initiating secondary immune response?
- A) memory cells
  - B) macrophages
  - C) B cells
  - D) T cells
  - E) stem cells
80. The organic and inorganic materials in all the organisms in the diagram will eventually return to the environment by the action of
- A) decomposers
  - B) producers
  - C) primary consumers
  - D) secondary consumers
  - E) top carnivores
81. Which of the following organisms is most likely to be located at the apex of the pyramid of biomass?
- A) Grass
  - B) Grasshopper
  - C) Snake
  - D) Mouse
  - E) Hawk
82. The gain in biomass, due to photosynthesis, remaining after respiratory loss (cellular respiration) in plants
- A) Symbiosis
  - B) Law of tolerance
  - C) Energy pyramid
  - D) Ecological succession
  - E) Net primary productivity

83. The relationship of a fungus and algae in a lichen

- A) Symbiosis
- B) Law of tolerance
- C) Energy pyramid
- D) Ecological succession
- E) Net primary productivity

84. 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

85. Members of which of the following are the major primary producers in the marine ecosystem?

- A) Cnidarians
- B) Sponges
- C) Sporozoans
- D) Fishes
- E) Algae