1. Phospholipids naturally form a bilayer in water because of

   I. acidic reactions between lipid chains and water
   II. dipole interactions between phosphate groups and water
   III. hydrophobic interactions between lipid chains

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

2. The monomer responsible for the formation of sulfide bonds in polypeptides is
   (A) cysteine
   (B) methionine
   (C) threonine
   (D) valine
   (E) none of the above

3. Which of the following functional groups are typically found in an amino acid?
   (A) Amino and hydroxyl
   (B) Amino and amino
   (C) Amino and aldehyde
   (D) Amino and carboxyl
   (E) Carboxyl and keto

4. The homogenous mixing of oil and water using a detergent is known as
   (A) combination
   (B) distribution
   (C) emulsion
   (D) homogenization
   (E) suspension

5. A reaction in which synthetic chemical activity produces a more highly ordered chemical organization and a higher free energy state is called:
   (A) chemiosmosis
   (B) catabolism
   (C) anabolism
   (D) photolysis
   (E) electron transport

6. The most accepted model of enzyme function is the
   (A) lock and key model
   (B) conformational hypothesis
   (C) substrate model
   (D) induced fit hypothesis
   (E) none of the above

7. Which of the following is NOT true of enzymes?
   (A) They reduce the energy required for most reactions.
   (B) They allow reactions to occur at body temperature.
   (C) They are usually unchanged, so can be reused, which increases efficiency.
   (D) They allow reactions to occur without the addition of ATP.
   (E) Their formation is genetically controlled.

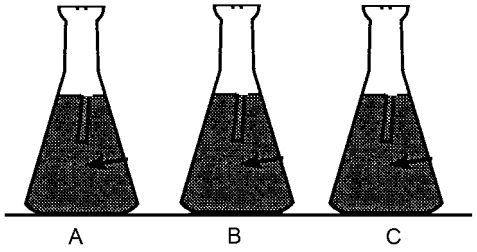
8. A small circle of DNA found outside the main chromosome in bacteria is called a
   (A) pilus
   (B) retrovirus
   (C) phage
   (D) capsid
   (E) plasmid

9. Base your answer to the following question on the information and diagram below.

   A biologist prepares an analysis of the activity of the enzyme Maltase, which promotes the hydrolysis of disaccharides to monosaccharides. Three flasks containing 10 milliliters of 4 percent maltose in water are prepared with the addition of the substances described below at time zero.

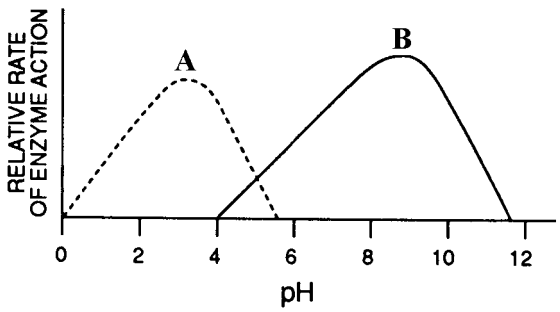
   Beaker A: Addition of 0.6 ml 1% Maltase Solution
   Beaker B: Addition of 0.6 ml Boiled Maltase Solution

   Beaker C: Addition of 0.6 ml Distilled Water



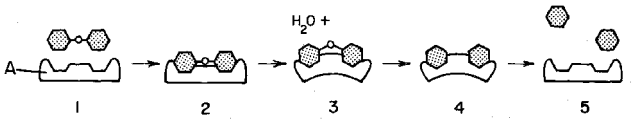
   If the object of this experiment was to test the effect of maltase on disaccharides, the control would be
   (A) flask A only
   (B) flask B only
   (C) flask C only
   (D) flask A and B
   (E) flask A and C

10. Base your answer to the following question on the graph below.



    Select the correct statement about the graph of enzyme activities.
    (A) Enzyme A works best at a basic pH.
    (B) Enzyme B works best at an acidic pH.
    (C) Enzyme B works best at a basic pH.
    (D) Each enzyme works over pH values 0 to 14.
    (E) Both enzymes work best at the same pH.

11. Question 46 is based on the reaction depicted below



Enzyme A functions in the cytoplasm as depicted. When excess galactose binds to an allosteric site not shown above, the enzyme becomes dormant. Enzyme A is

(A) constitutive and inducible
(B) constitutive and repressible
(C) regulative and inducible
(D) denatured and irreversible
(E) toxic and irreversible

12. Which of the following is true of a ^{12}C molecule and a ^{14}C molecule?

(A) They have a different number of electrons.
(B) They have the same number of neutrons.
(C) They have the same number of protons.
(D) They have different kinds of atoms.
(E) They have the same molecular weight.

13. A student looking through a compound light microscope correctly decides that she is observing a eukaryotic cell because

(A) mitochondria are visible
(B) vacuoles are present
(C) chlorophyll is present
(D) a cell wall is present
(E) it has flagella

14. Which of the following organelles is involved in storage, modification, and packaging of secretory products produced by the ribosomes?

(A) The lysosome
(B) The mitochondrion
(C) The endoplasmic reticulum
(D) The Golgi apparatus
(E) The nucleolus

15. A cell that lacks peroxisomes is unable to

(A) provide enough energy to the cell
(B) rid the cell of toxic substances
(C) synthesize proteins in the cell
(D) store organic molecules in the cell
(E) phagocytocize foreign particles entering the cell

16. What is the function of centrioles?

(A) They cause cytokinesis by the concentric shortening of microtubules.
(B) They produce microtubules for the chromosomes to migrate along as they move to opposite poles of the cell.
(C) They are required for DNA replication
(D) They enable bacteria to move
(E) None of the above

17. Alcohol is detoxified in

(A) lysosomes
(B) peroxisomes
(C) rough endoplasmic reticulum
(D) smooth endoplasmic reticulum
(E) none of the above

18. Diffusion of material involves which of the following?

(A) The movement of a substance up its concentration gradient.
(B) The movement of water with the current.
(C) The movement of a substance from a low concentration to a high concentration.
(D) The movement of a substance from a high concentration to a low concentration.
(E) The movement of material.

19. Sodium-potassium pumps in the cell membrane are examples of

(A) antiports
(B) symports
(C) uniports
(D) *cis*-ports
(E) none of the above

20. Anaerobic respiration in fungi includes all of the following conversion pathways EXCEPT

(A) ethanol to CO_2
(B) glucose to pyruvic acid
(C) pyruvic acid to ethyl alcohol
(D) pyruvic to lactic acid
(E) NADH to NAD^+

21. In anaerobic respiration, ATP is formed through

(A) hydrolysis
(B) enzyme-deficient anabolism
(C) substrate-level phosphorylation
(D) chemiosmosis
(E) oxidative phosphorylation

22. Which of the following sugars is produced under anaerobic conditions?

(A) Cellulose
(B) Glucose
(C) Glycogen
(D) Fructose
(E) Lactose

23. If 2 molecules of pyruvate are supplied to an aerobic eukaryotic cell in place of a glucose molecule, the net output of ATP after complete metabolism would be

(A) 2 ATP
(B) 4 ATP
(C) 34 ATP
(D) 36 ATP
(E) 38 ATP

24. C_4 plants store CO_2 so that stomata stay open for less time. This is to prevent excess

(A) adhesion
(B) CO_2 intake
(C) evaporation
(D) O_2 release
(E) transpiration

25. During cellular respiration, most ATP molecules are generated via
    (A) the Kreb's cycle and the electron transport chain
    (B) fermentation and the electron transport chain
    (C) glycolysis and the electron transport chain
    (D) the Kreb's cycle and glycolysis
    (E) substrate phosphorylation and fermentation

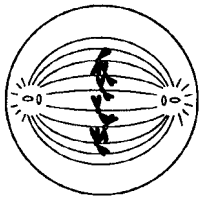
26. Where does the electron transport chain take place inside the cell?
    (A) The folds of the inner mitochondrial membrane.
    (B) On the ribosome.
    (C) In the cell cytoplasm.
    (D) In the mitochondrial matrix.
    (E) On the outer membrane of the mitochondria membrane.

27. The gas needed for photosynthesis is
    (A) CO_2 obtained by diffusion through the upper epidermis
    (B) CO_2 obtained by diffusion regulated by guard cells
    (C) H_2O obtained by osmosis through veins
    (D) O_2 obtained by diffusion through veins
    (E) O_2 obtained by diffusion regulated by guard cells

28. Noncyclic photophosphorylation in photosynthesis activates
    (A) PS I only
    (B) PS II only
    (C) PS I then PS II
    (D) PS II then PS I
    (E) PS I and PS II simultaneously

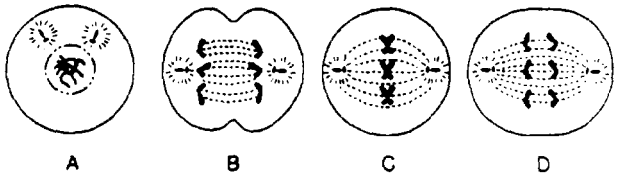
29. At what phase of the cell cycle does DNA replication occur?
    (A) G0
    (B) G1
    (C) S
    (D) M
    (E) None of the above

30. Base your answer to the following question on the picture below.



    What phase of mitosis is shown in the picture?
    (A) Interphase
    (B) Metaphase
    (C) Prophase
    (D) Telophase
    (E) Anaphase

31. Base your answer to the following question on the diagram below.



    Cleavage furrow can be seen in which state of mitosis?
    (A) A
    (B) B
    (C) C
    (D) D
    (E) None of the above

32.

    Where would you most likely observe mitotic division?
    (A) Cambium cells
    (B) Cartilage
    (C) Ligaments
    (D) Muscle cells
    (E) Neurons

33. Base your answer to the following question on on the information given below.

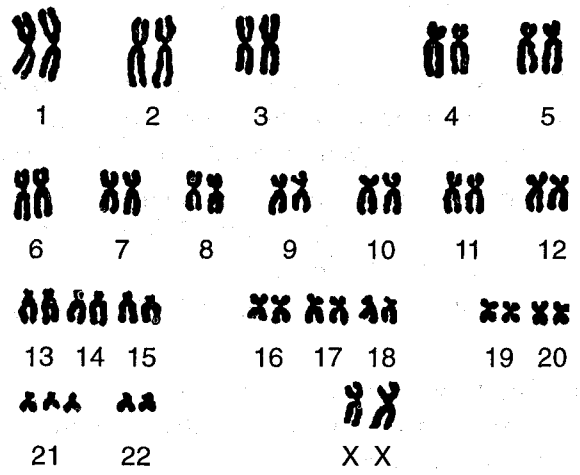
    A patient is diagnosed with Stage I lymphatic cancer in which the cancer is contained within one lymph node.

    Cancer cells divide continuously. In order to do this, they must bypass the restriction point, which normally requires that they have
    (A) small surface area:volume ratio
    (B) large cytoplasmic volume:genome size ratio
    (C) excessive cytoplasmic organelles
    (D) both a and b
    (E) a, b and c

34. Recombination of DNA occurs in
    (A) prophase I
    (B) telophase I
    (C) anaphase II
    (D) prophase II
    (E) metaphase II

35. Which of the following accurately describes crossing-over?
    (A) Genes located far apart on the chromosome have a high likelihood of being separated by the exchange of segments.
    (B) Genes located far apart on the chromosome have a low likelihood of being separated by the exchange of segments.
    (C) Genes located far apart on the chromosome cannot be linked.
    (D) Crossing-over decreases genetic variability.
    (E) Crossing-over occurs during Anaphase of Mitosis.

36. Base your answer to this question on the karyotype shown below.



The results of the karyotype indicate that this individual has which of the following genetic disorders?

(A) Down Syndrome
(B) Klinefelter Syndrome
(C) Turner Syndrome
(D) Phenylketonuria
(E) Sickle-cell anemia

37. How many genetically different sex cells can an organism with four independently sorting gene pairs, PpGgDdMm, produce?

(A) 4
(B) 6
(C) 10
(D) 12
(E) 16

38. During what stage of the human life cycle does oogenesis begin?

(A) Embryonic development
(B) Birth
(C) Puberty
(D) First menstrual cycle
(E) Fertilization

39. What is the chance of a woman and her husband having 6 daughters in a row?

(A) 1/6
(B) 1/12
(C) 1/32
(D) 1/64
(E) 1/128

40. A woman with genotype AaBb mates with a man with genotype AABb. Assuming independent assortment and random recombination, what is the chance that the child will have the genotype AABB?

(A) 1/16
(B) 2/16
(C) 4/16
(D) 6/16
(E) 8/16

41. A couple has 6 children and all of them are female. The probability that the couple's 7th child is a male is

(A) 1/49
(B) 1/7
(C) 1/6
(D) 1/2
(E) 6/7

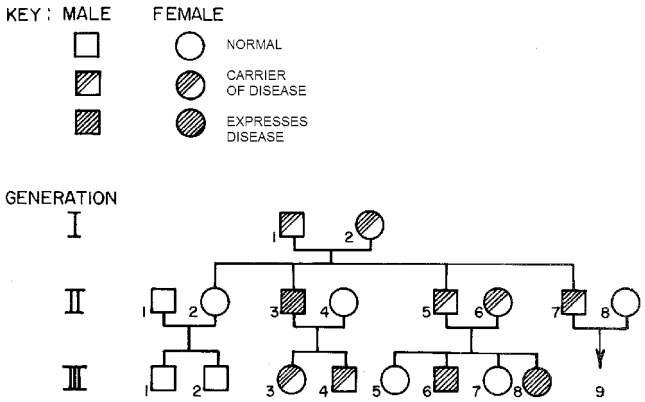
42. An organism with genotype QqRr only produces two gamete genotypes, QR and qr. This violates which principle of Mendelian genetics?

(A) Codominance
(B) Dominance
(C) Independent Assortment
(D) Linkage
(E) Segregation

43. A father has type A negative blood. He and his wife have a child with type O positive. The mother can be which of the following blood types?

(A) AB positive
(B) AB negative
(C) A positive
(D) B negative
(E) O negative

44. Refer to the following pedigree that illustrates the inheritance of pattern of disease "S".



According to the diagram, disease "S" can be classified as which of the following?

(A) It is an autosomal recessive disease.
(B) It is an X-linked recessive disease.
(C) It is an X-linked dominant disease.
(D) It is an autosomal dominant disease.
(E) The inheritance pattern of disease "S" does not have a genetic basis.

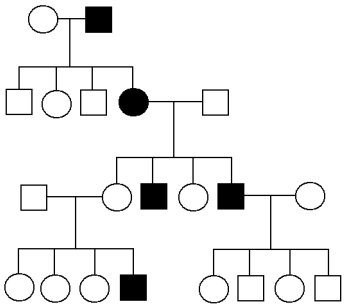
45. Viruses can incorporate their DNA into the host's chromosome and remain latent. The term for this is type of replication is called

(A) conjugation
(B) lysogenic
(C) lytic
(D) transduction
(E) transformation

46. Rosalind Franklin's pictures of the DNA double helix were taken using the technique known as

(A) bright field microscopy
(B) diffraction
(C) fluorescence
(D) transmission electron microscopy
(E) x-ray crystallography

47.



Assuming complete penetrance, the most likely genetic mechanism to explain the inheritance of this trait is

(A) incomplete dominance
(B) x-linked dominant
(C) x-linked recessive
(D) autosomal dominant
(E) autosomal recessive

48. The 5' end of a DNA nucleotide can be identified by the location of

(A) carbon
(B) hydrogen bonds
(C) nitrogenous bases
(D) oxygen
(E) phosphate group

49. What is the function of DNA ligase?

(A) Bind nucleotides together during transcription
(B) Bind nucleotides together during translation
(C) Bring together the Okazaki fragments
(D) Unwind the double helix
(E) Cut and rejoin the helix

50. The synthesis of DNA from RNA requires which enzyme?

(A) Reverse transcriptase
(B) RNA polymerase
(C) Reverstase
(D) DNA polymerase I
(E) RNA polymerase

51. Which of the following is the correct sequence of RNA that results from the transcription of the DNA sequence 5'-GTA CAA AGT- 3'?

(A) 3'- CAT GTT TCA- 5'
(B) 3'- GTA CAA AGT- 5'
(C) 3'- CAU GUU UCA-5'
(D) 3'- GUA CAA AGU- 5'
(E) 3' – TGA AAC ATG- 5'

52. Which mutation can result in a change in the reading frame?

(A) deletion
(B) inversion
(C) an adquine changing to guanine in a codon's third base
(D) substitution
(E) point

53. Microevolution depends on

(A) genetic mutations
(B) genetic drift
(C) gene flow
(D) natural selection
(E) all of the above

54. Which of the following is true of restriction enzymes?

(A) They are capable of cutting DNA into fragments at specific points in the nucleotide sequence.
(B) They enable plasmids to enter bacterial cells.
(C) They prevent plasmids from entering bacterial cells.
(D) They form bonds between DNA fragments.
(E) They are used for cell recognition.

55. A bacteriophage, plasmid, or other agent that transfers genetic material from one cell to another is called a(n)

(A) RFLP
(B) enzyme
(C) genetic fingerprint
(D) PCR
(E) vector

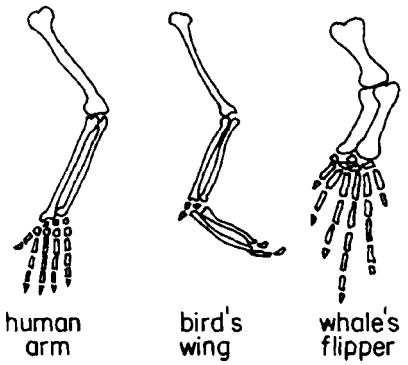
56. Which of the following gases was NOT utilized in Miller's famous experiment, which showed that the release of a spark into a gaseous mixture would produce various organic compounds?

(A) Oxygen gas
(B) Ammonia gas
(C) Hydrogen gas
(D) Methane gas
(E) Water vapor

57. In the Miller-Urey experiment, application of electric sparks to simple gases resulted in the formation of

(A) steroids
(B) ozone
(C) simple amino acids
(D) polysaccharides
(E) RNA

58.



The diagram best represents which of the following?

(A) Survival of the fittest
(B) Aquired characteristics
(C) Common Ancestry
(D) Reproductive isolation
(E) Convergence

59. The similarity of human embryo pharyngeal grooves to the gills of fish provides evidence for

(A) convergent evolution
(B) genetic drift
(C) neutral selection
(D) ontogeny recapitulating phylogeny
(E) point origin

60. The type of selection that occurs when the environment favors extreme or unusual traits, while selecting against the common traits is
(A) Stabilizing selection
(B) Directional selection
(C) Disruptive selection
(D) Sexual selection
(E) Artificial selection

61. The fixed frequency of homozygous dominant condition of a trait in a population exhibiting Hardy-Weinberg equilibrium is 16%. What is the frequency of the dominant allele in the gene pool?
(A) 0.16
(B) 024
(C) 0.36
(D) 0.4
(E) 0.8

62. One group of members of a given species is experimentally placed on the west side of a mountain while the other group of members of a given species is experimentally placed on the east side of a mountain. After many generations separated from one another, the two groups are rejoined but are now unable to mate with one another. This experiment demonstrated which evolutionary process?
(A) Allopatric speciation
(B) Sympatric speciation
(C) Adaptive radiation
(D) Genetic drift
(E) The bottleneck effect

63. All of the following are phyla EXCEPT
(A) Platyhelminthes
(B) Crustaceans
(C) Annelids
(D) Echinoderms
(E) Poriferans

64. Which of the following genus and species name is written correctly?
(A) escherichia Coli
(B) Escherichia Coli
(C) escherichia coli
(D) *Escherichia Coli*
(E) *Escherichia coli*

65. Which of the following are photosynthetic protists in a community?

I. Rhodophyta
II. Sporozoa
III. Dinoflagellata

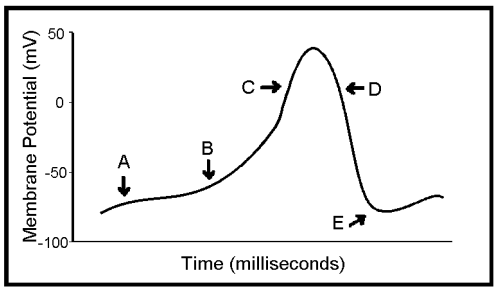
(A) I only
(B) II only
(C) III only
(D) I and III only
(E) I, II, and III

66. Which of the following is a true statement about fungi?
(A) Fungi contain chlorophyll.
(B) Fungi are carnivorous.
(C) Fungi are decomposers.
(D) Fungi are single-celled.
(E) Fungi are only capable of asexual reproduction.

67. A student examining the apical meristem in plant root cells would most likely observe
(A) the plant is undergoing meiosis
(B) the plant undergoing mitosis
(C) the plant is not undergoing either meiosis or mitosis
(D) the plant is maturing
(E) none of the above

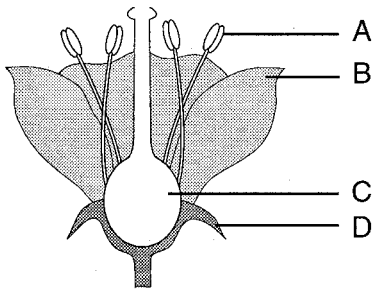
68. Greatest support of the stem and leaves are typical of which tissue type?
(A) epidermal
(B) parenchyma
(C) sclerenchyma
(D) meristematic
(E) chlorenchyma

69. Base your answer to the following question on the diagram below of an action potential in a neuron.



Hyperpolarization of the neuron
(A) A
(B) B
(C) C
(D) D
(E) E

70. Base your answer to the following question on the diagram of a flower shown below.



The structure labeled *C* is
(A) the ovary
(B) the stalk
(C) the micropyle
(D) the filament
(E) the anther

71. Which organism is paired with the wrong phylum?
(A) sponge - Porifera
(B) lobster - Mollusk
(C) flatworm - Platyhelminthes
(D) spider - Arthropoda
(E) sea cucumber - Echinoderm

72. Angiosperms are divided into monocots and dicots. Which of the following statements is INCORRECT?
    (A) Monocots have one cotyledon
    (B) In dicots, flower parts occur in groups of four and five and multiples thereof.
    (C) Dicots have a netted patter of leaf veins.
    (D) In monocots, flower parts occur in groups of three and multiples thereof.
    (E) Monocots have vascular bundles which form a ring around the central pith

73. Phototropism refers to how plants respond to sunlight by bending towards the light. This is the result of
    (A) cell division on the side of the stem closer to the light source
    (B) cell division on the side of the stem away from the light source
    (C) cell differentiation on the side of the stem away from the light source
    (D) cell elongation of the side of the stem away from the light source
    (E) cell elongation on the side of the stem closer to the light source

74. These organisms have solid bodies because the area between the outer wall and digestive tract is filled with cells.
    (A) Acoelomates
    (B) Pseudocoelomates
    (C) Coelomates
    (D) Acoelomates and Coelomates
    (E) Pseudocoelomates and Coelomates

75. Which of the following statements about Echinoderms is true?
    (A) Echinoderms have radial symmetry, a coelomate, and are deuterostomes.
    (B) Echinoderms have bilateral symmetry, a pseudo-coelomate, and are deuterostomes.
    (C) Echinoderms have bilateral symmetry, a coelomate, and are protostomes
    (D) Echinoderms have bilateral symmetry, a coelomate, and are deuterostomes.
    (E) Echinoderms have bilateral symmetry, a coelomate, and are protostomes

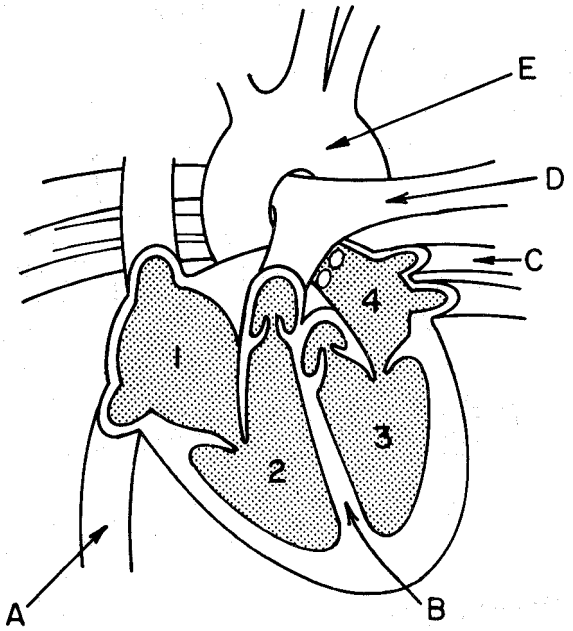
76. If the temperature was suddenly decreased in an environment, the organism most likely to be affected by this change would be a(n)
    (A) human
    (B) bird
    (C) whale
    (D) amphibian
    (E) cow

77. The optimum pH and body site for pepsin activity is
    (A) 7, oral cavity
    (B) 8, oral cavity
    (C) 2, stomach
    (D) 11, stomach
    (E) 5, small intestine

78. Base your answer on the diagram below, which shows the cross-section of an organism.

The section labeled *A* is
    (A) a root hair
    (B) cilia
    (C) flagella
    (D) villi
    (E) setae

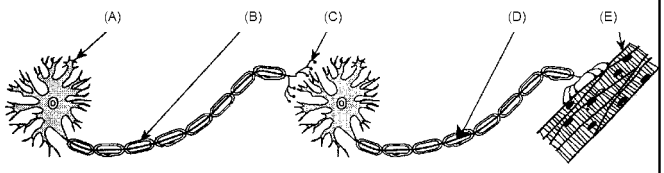
79. Base your answer to the following question on the diagram below.



This structure can be found in which of the following organisms?
    (A) Cartilagenous fish
    (B) Frog
    (C) Bat
    (D) Bony fish
    (E) Salamander

80. Which of the following sequences describes the passage of an action potential in the neuron?
    (A) axon, cell body, dendrite, synaptic cleft
    (B) synaptic cleft, axon, dendrite, cell body
    (C) dendrite, synaptic cleft, cell body, axon
    (D) dendrite, cell body, axon, synaptic cleft
    (E) synaptic cleft, axon, cell body, dendrite

81. Base your answer on the diagram below.



Acetylcholine is released from the synaptic vessicles located at this site.

(A) A
(B) B
(C) C
(D) D
(E) E

82. $X + Y \rightarrow XY + energy$

Which of the following best characterizes the reaction represented above?

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

83. Which of the following structure and function is incorrectly paired?

(A) sclera - provides support and protection for inner contents of the eye
(B) pupil - allows light to enter the eye
(C) cones - detect color
(D) rods - detect light and dark
(E) iris - focuses the image

84. The rate of H_2O reabsorption from the collecting duct of the nephron is most highly influenced by which of the following?

(A) Antidiuretic hormone
(B) Adrenocorticotropic hormone
(C) Growth hormone
(D) Glucagon
(E) Parathormone

85. Production and storage of bile occurs in the

(A) liver; stomach
(B) liver; gall bladder
(C) stomach; colon
(D) pancreas; gall bladder
(E) colon; small intestine

86. Hemoglobin's affinity for oxygen would be lowered as a result of

I. high carbon dioxide levels
II. high nitrogen levels
III. high hydrogen ion levels

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

87. Which bands and/or zones in a sarcomere shorten when a skeletal muscle contracts?

(A) H band and I band
(B) A band
(C) H band, I band and A band
(D) A band and Z zone
(E) I band and Z zone

88. A urinalysis of an individual with diabetes mellitus most likely will report which of the following in the urine?

(A) Glucose
(B) Salt
(C) Erythrocytes
(D) Lymphocytes
(E) Protein

89. Cardiac muscle is similar to smooth muscle in all of the following ways EXCEPT

(A) location of muscle in the body
(B) number of nuclei per cell
(C) mechanism of control
(D) texture and shape
(E) both A and D

90. During which stage in embryonic development do cells differentiate into three germ layers?

(A) Blastula
(B) Gastrula
(C) Zygote
(D) Neurula
(E) Morula

91. The endoderm of a developing human gastrula would give rise to all of the following EXCEPT

(A) the pancreas
(B) the liver
(C) the lining of the digestive system
(D) the lungs
(E) the gonads

92. Which of the following types of behavior describes the way that dogs learn to salivate to the ringing of a bell?

(A) Habituation
(B) Instinct
(C) Reasoning
(D) Trial and error
(E) Conditioning

93. Organisms that have the exact same source of nutrition within a food web can be best described as

(A) providing links in the food chain
(B) occcupying the same trophic level
(C) being omnivores
(D) being herbivores
(E) being tertiary consumers in the food chain

94. Reproduction is an essential feature of animal life. **Compare** and **contrast** asexual and sexual reproduction. Include **advantages** and **disadvantages** of both.

95. The polymerase chain reaction (PCR) and gel electrophoresis are both used in modern genetics.

    a.) **Describe** what they are.

    b.) **Describe** how they are used.

    c.) **List** situations in which they are beneficial to the development of further knowledge about human genomics.

96. The purpose of mitosis is cell replication. **Describe** the process, as well as all phases of the cell cycle. **Include** a brief description of **each stage** of mitosis.

97. Changes in allele frequencies and genotype frequencies within populations are caused by the actions of several different evolutionary agents. **Discuss** the possible roles of each of the following factors in the change in genetic structure of populations.

    a.) mutation

    b.) genetic drift

    c.) migration

98. Genetic crosses allow for conclusions to be drawn regarding the genotype of specific organisms.

    a.) How would you test the genotype of a parent expressing the dominant phenotype?

    b.) What would the results be if the parent were a homozygote dominant?

    c.) What would the results be if the parent were a heterozygote dominant?

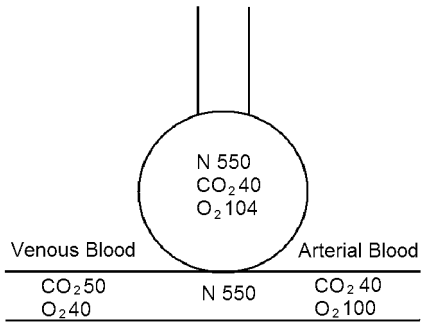
99. In each of the below scenarios, give your expected diagnosis and **explain** what is occurring to each patient. **Include** what you would look for in lab tests.

    a.) Patient A complains of constant thirst and frequent urination.

    b.) Patient B has a fractured bone and is an elderly female. This is the third time she has fractured a bone in the last year.

    c.) Patient C, a 45 year old male, comes in to your office after having grown numerous inches in one year.

100. The diagram below depicts an alveolus and the partial pressure of different gases in the bloodstream and alveolus. **Explain** the gas exchange that occurs in alveoli.



Answer Key

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

Answer Key

61. D
62. A
63. B
64. E
65. D
66. C
67. B
68. C
69. E
70. A
71. B
72. E
73. D
74. A
75. A
76. D
77. C
78. E
79. C
80. D
81. C
82. A
83. E
84. A
85. B
86. E
87. A
88. A
89. E
90. B
91. E
92. E
93. B

94. Asexual reproduction produces offspring that are genetically identical to the parent and to each other. Advantages of asexual reproduction are avoidance of risks associated with mating, and efficient use of resources. A disadvantage of asexual reproduction is lack of genetic diversity. Means of asexual reproduction include budding, regeneration, and parthenogenesis. Asexually reproducing organisms tend to be sessile and therefore cannot search for mates, or species that live in sparse populations and rarely encounter potential mates.
Sexual reproduction consists of three basic steps: gametogenesis, mating, and fertilization. Genetic diversity is created by the recombination of genes during gametogenesis and by the independent assortment of chromosomes. Mating and fertilization also contribute to genetic diversity. In animals, sexual reproduction encompasses the fusion of two distinct gametes to form a zygote. Gametes are produced by a type of cell division called meiosis. The gametes are haploid (containing only one set of chromosomes) while the zygote is diploid (containing two sets of chromosomes). In most cases, the male gamete, called the spermatozoon, is relatively motile and usually has flagella. On the other hand, the female gamete, called the ovum, is nonmotile and relatively large in comparison to the male gamete. There are two mechanisms by which fertilization can take place. The first is external (the eggs are fertilized outside of the body); the second is internal (the eggs are fertilized within the female reproductive tract). A disadvantage of sexual reproduction is that it is not a continuous activity. It is subject to certain patterns and cycles. Oftentimes these patterns and cycles may be linked to environmental conditions which allow organisms to reproduce effectively. For example, many animals have estrous cycles that occur during certain parts of the year so that offspring can typically be born under favorable conditions. Likewise, these cycles and patterns can be controlled by hormonal cues as well as other seasonal cues like rainfall. These cycles and patterns allow organisms to manage the relative expenditure of energy for reproduction and maximize the chances of survival for the resulting offspring.

95. a./b.) The polymerase chain reaction is a way to make multiple copies of a fragment of DNA. A starting template is needed, along with primers, free nucletodies, and DNA ligase. The steps of the PCR reaction are denaturation, annealing, and elongation. The steps continue for 30 to 40 cycles. The copied DNA can be used as the material to run in gel electrophoresis experiments. Gel electrophoresis allows DNA fragments, cut in specific location by restriction enzymes, to be separated based on size. c.) In combination, these two techniques are used in DNA fingerprinting, paternity testing, HIV testing, drug development, detection of mutations, and genetic sequencing.

96. Mitosis is the process of cell replication. In G1, the first phase, the cell grows. The S phase is the DNA synthesis phase in which the chromosomes are replicated, which is followed by G2, in which the cell continues to grow. The cell then enters the mitotic phase. In the

Answer Key

first stage of mitosis, prophase, the chromatin condense into chromosomes. The nuclear membrane breaks down, forming vesicles. In the next phase, metaphase, the chromosomes line up on the equatorial plate. The centromeres then divide, separating the sister chromatids, pulling them towards the poles, during anaphase. In telophase, the microtubules disappear and the chromatin recoils. The nuclear envelope redevelops. The cytoplasm divides during cytokinesis, in which the cell membrane pinches inwards, forming two daughter cells.

97. a.) Most mutations are harmful or neutral to their bearers, but if the environment changes, previously neutral or harmful alleles may become advantageous. In addition, mutations can restore alleles to populations that other evolutionary agents removed. Thus, mutations help create and maintain variation within populations.
b.) Genetic drift alters allele frequencies primarily in small populations. Organisms that normally have large populations may pass through occasional periods when only a small number of individuals survive, also called bottlenecks. New populations established by a few founding immigrants also have gene frequencies that differ from those in the parent population.
c.) The migration of individuals from one population to another, followed by breeding in the new location, produces gene flow. Immigrants may introduce new alleles into a population or may change the frequencies of alleles already present. Emigrants may remove alleles from a population when they leave.

98. a.) A testcross is a cross between a homozygous recessive parent and a dominant parent. The results help to distinguish the genotype of the dominant parent.
b.) If the parent were a homozygote dominant, the testcross' F1 generation would consist of 100% of the progeny with the dominant phenotype.
c.) If the parent were a heterozygote dominant, the testcross' F1 generation would consist of 50% of the progeny with the dominant phenotype, and 50% of the progeny with the recessive phenotype.

99. a.) Patient A most likely is suffering from diabetes, which occurs due to a deficiency of insulin. This results in high levels of glucose in the blood because there is not enough insulin to convert the glucose to glycogen, for storage. A test for glucose, or sugar, in the blood would reveal high glucose levels in diabetics.
b.) Patient B most likely is suffering from osteoporosis, which causes bones to become fragile and break. It is often caused by low levels of calcium in the bones, or higher than normal levels of calcium in the blood. An under-active thyroid gland, which secrets calcitonin, or an overactive parathyroid, which secrets PTH, could be responsible. A test for blood calcium levels would help determine if either of these are the reason for the break.
c.) This patient most likely has acromegaly, which is caused by the oversecretion of growth hormone. To test for this, blood levels of GH can be evaluated.

100. The differences in the partial pressures of the gases in the lungs and blood allows for the diffusion of gases. Oxygen diffuses from the alveoli into the arteries, while carbon dioxide diffuses from the venous blood into the alveoli. The partial pressure of nitrogen is equal in the bloodstream and the alveoli, and there is no overall net diffusion. This allows for oxygen-rich blood to be transported systemically, and for carbon dioxide to be returned to the lungs for expulsion.

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Displaying UNIT CHAPTER TOPIC SUBTOPIC QUESTION ID

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Eduware Genealogy by Category

AP Biology Sample Exam

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