

Biology Test (Introduction)

Science Olympiad Anatomy and Physiology

Name _____ **Answer Key** _____

Directions: *Select the best answer to each question.*

- _____ 1. Which of the following is not a function of water in living organisms?
- a. solvent
 - b. temperature buffer
 - c. metabolite
 - d. none of the above**
- _____ 2. Which of the following monosaccharides is a hexose?
- a. mannose
 - b. galactose
 - c. sucrose
 - d. both a and b**
- _____ 3. Which of the following is true of glucose?
- a. source of energy when metabolized
 - b. soluble in aqueous solutions
 - c. exists in alpha and beta forms
 - d. all of the above**
- _____ 4. Maltose and lactose are what of each other?
- a. dimers
 - b. isomers**
 - c. disaccharides
 - d. both b and c
- _____ 5. The chemical process by which polysaccharides are formed is called what?
- a. condensation polymerization**
 - b. hydrolysis chaining
 - c. hydrogen bonding
 - d. dehydration decomposition
- _____ 6. What type of polysaccharide stores energy in humans?
- a. glycogen**
 - b. starch
 - c. adipose
 - d. both a and c

- _____ 7. Which of the following sugars is non-reducing?
- a. maltose
 - b. sucrose**
 - c. ribose
 - d. all of the above
- _____ 8. How many amino acids cannot be synthesized by the adult human body?
- a. nine**
 - b. eleven
 - c. twenty
 - d. twenty-two
- _____ 9. Peptide bonds are broken by which type of reaction?
- a. hydrolysis**
 - b. dehydration
 - c. condensation
 - d. dissociation
- _____ 10. Which of the following molecules is not a protein?
- a. hemoglobin
 - b. insulin
 - c. cholesterol**
 - d. both b and c
- _____ 11. What is the secondary structure of a protein?
- a. order of amino acids
 - b. orientation of sheets and helices**
 - c. arrangement of multiple chains
 - d. globular or fibrous structure
- _____ 12. Structures of a protein are determined by interactions between their what?
- a. R-groups**
 - b. alpha carbons
 - c. carboxyl groups
 - d. hydrogen ions
- _____ 13. What level of structure would be expected to be reached by an oligopeptide?
- a. primary
 - b. secondary
 - c. tertiary**
 - d. quaternary

- _____ 14. Which of the following is never an example of a lipid?
- a. steroid
 - b. hormone
 - c. triglyceride
 - d. none of the above**
- _____ 15. Which of the following is not a biological function of lipids?
- a. energy storage
 - b. chemical messaging
 - c. waterproofing
 - d. none of the above**
- _____ 16. Fatty acids all contain which type of functional group?
- a. carboxylic acid**
 - b. ester
 - c. alcohol
 - d. both a and c
- _____ 17. How many phosphate groups are present in a single phospholipid?
- a. one**
 - b. two
 - c. three
 - d. either a or b
- _____ 18. Which of the following is not a characteristic of unsaturated fatty acids?
- a. has a double bond in carbon chain
 - b. polyunsaturated with multiple double bonds
 - c. solid at room temperature**
 - d. none of the above
- _____ 19. What are the components of a triglyceride?
- a. three glycerols and one fatty acid chain linked through covalent bonding
 - b. three glycerols and one fatty acid chain linked through hydrogen bonding
 - c. three fatty acid chains and one glycerol linked through covalent bonding**
 - d. three fatty acid chains and one glycerol linked through hydrogen bonding
- _____ 20. Which of the following organic bases is not a purine?
- a. adenine
 - b. guanine
 - c. thymine**
 - d. both a and b

_____ 21. How many hydroxyl groups are present in ribose?

- a. two
- b. three
- c. four**
- d. five

_____ 22. What are the three components of a nucleotide?

- a. phosphate groups, hydrogenous base, five-carbon sugar
- b. phosphate groups, hydrogenous base, six-carbon sugar
- c. phosphate groups, nitrogenous base, five-carbon sugar**
- d. phosphate groups, nitrogenous base, six-carbon sugar

_____ 23. Which of the following is not true of DNA?

- a. formed by two covalently bonded polynucleotide chains**
- b. double-ring purines complement single-ring pyrimidines
- c. structure is double helical with antiparallel strands
- d. none of the above

_____ 24. What is the complementary DNA strand to 5' - ACG CGC TCG ATG - 3'?

- a. 5' - CAT CGA GCG CGT - 3'**
- b. 5' - CUT CGU GCG CGU - 3'
- c. 5' - TGC GCG AGC TAC - 3'
- d. 5' - UGC GCG AGC UAC - 3'

_____ 25. What type of RNA is transcribed in the nucleus of the cell?

- a. rRNA
- b. mRNA**
- c. tRNA
- d. snRNA

_____ 26. What type of bond holds base pairs together in RNA?

- a. hydrogen**
- b. peptide
- c. covalent
- d. none of the above

_____ 27. Which of the following correctly orders the sequence of the central dogma of biology?

- a. translation → transcription → replication
- b. transcription → translation → replication
- c. replication → transcription → translation**
- d. replication → translation → transcription

- _____ 28. Which of the following is not an aspect of cell theory?
- a. every living organism is composed of one or more cells
 - b. the cell is the fundamental unit of structure and organization in organisms
 - c. all living cells arise from preexisting cells via cell division
 - d. none of the above**
- _____ 29. What membrane-bound organelle functions in energy conversion?
- a. Golgi apparatus
 - b. mitochondrion**
 - c. smooth endoplasmic reticulum
 - d. rough endoplasmic reticulum
- _____ 30. Lysosomes function in which of the following categories?
- a. manufacturing
 - b. breakdown**
 - c. energy processing
 - d. communication
- _____ 31. Which of the following structures supports the movement of organelles within a cell?
- a. cytoskeleton**
 - b. Golgi apparatus
 - c. vesicles
 - d. cell junctions
- _____ 32. Which of the following is the primary function of ribosomes in human cells?
- a. detoxification
 - b. metabolic processes
 - c. polypeptide synthesis**
 - d. calcium ion storage
- _____ 33. What organelle is responsible for lipid synthesis in the cell?
- a. peroxisomes
 - b. nuclear envelope
 - c. Golgi apparatus
 - d. smooth endoplasmic reticulum**
- _____ 34. Which of the following is not true about the cell membrane?
- a. embedded cholesterol molecules help maintain its fluidity
 - b. interior is nonpolar while exterior is polar
 - c. glycoproteins with oligosaccharide chains help stabilize it
 - d. O₂ and CO₂ cross it through active transport protein channels**

- _____ 35. Which of the following ions is not found in cytosol?
- a. K^+
 - b. Ca^{2+}
 - c. Cl^-
 - d. none of the above**
- _____ 36. Which of the following is not an example of a specialized cell?
- a. neuron
 - b. epithelial cell**
 - c. gamete
 - d. none of the above
- _____ 37. Melanocytes are specialized cells that function in which of the following?
- a. synthesizing protective pigments in skin**
 - b. strengthening and waterproofing the skin
 - c. participating in humoral immune responses
 - d. aggregating stimuli into afferent nerve impulses
- _____ 38. What type of cell differentiates in adult humans?
- a. stem cells**
 - b. epithelial cells
 - c. gametes
 - d. all mitotic cells
- _____ 39. Which of the following is a type of bulk transport?
- a. pinocytosis
 - b. phagocytosis
 - c. endocytosis
 - d. all of the above**
- _____ 40. Through what type of transport does glucose typically enter a cell?
- a. simple diffusion
 - b. facilitated diffusion**
 - c. endocytosis
 - d. none of the above
- _____ 41. Which of the following is an example of active transport?
- a. facilitated diffusion
 - b. osmosis
 - c. exocytosis**
 - d. none of the above

- _____ 42. Why is saline used over distilled water in clinical applications?
- a. it is isotonic**
 - b. it is hypotonic
 - c. it is hypertonic
 - d. it is anhydrous
- _____ 43. What happens to erythrocytes immersed in a hypotonic solution?
- a. cytolysis**
 - b. crenation
 - c. hypertrophy
 - d. all of the above
- _____ 44. Macrophages participate in immune responses through what type of transport?
- a. phagocytosis
 - b. exocytosis
 - c. endocytosis
 - d. both a and c**
- _____ 45. What part of the human brain is responsible for maintaining homeostasis?
- a. pons
 - b. corpus callosum
 - c. hypothalamus**
 - d. medulla oblongata
- _____ 46. What is an effector in homeostatic systems?
- a. sensing mechanism
 - b. nullifying mechanism
 - c. intensifying mechanism
 - d. either b or c**
- _____ 47. Which of the following is an example of a receptor?
- a. efferent neuron
 - b. afferent neuron**
 - c. interneuron
 - d. none of the above
- _____ 48. What is the result of negative feedback?
- a. original stimulus is enhanced
 - b. variant condition is canceled**
 - c. homeostasis is not maintained
 - d. blood sugar is regulated

_____ 49. Which of the following is not true of negative feedback?

- a. **conditions are constantly monitored by effectors**
- b. corrective action is discontinued once conditions return to normal
- c. the integrator evaluates changes in conditions
- d. none of the above

_____ 50. In which of the following events would positive feedback occur?

- a. digestion
- b. vasodilation
- c. **hemorrhage**
- d. none of the above

_____ 51. What begins both aerobic and anaerobic respiration?

- a. Krebs cycle
- b. **glycolysis**
- c. fermentation
- d. phosphorylation

_____ 52. What does ADP bond with to form ATP?

- a. H⁺
- b. H₂O
- c. NADH
- d. **P_i**

_____ 53. What is the chemical formula of pyruvate?

- a. C₃H₃O₃
- b. **C₃H₄O₃**
- c. C₃H₅O₃
- d. C₃H₆O₃

_____ 54. What is the product of pyruvate decarboxylation?

- a. acetyl-CoA
- b. NADH
- c. CO₂
- d. **all of the above**

_____ 55. The reduction of one NAD⁺ to one NADH yields how many ATP in glycolysis?

- a. **2 ATP**
- b. 3 ATP
- c. 4 ATP
- d. none of the above

- _____ 56. Where in the cell does the citric acid cycle take place?
- a. cellular cytosol
 - b. mitochondrial matrix**
 - c. mitochondrial cristae
 - d. both b and c
- _____ 57. What is acetyl-CoA ultimately broken down into through the TCA cycle?
- a. NADH
 - b. CO₂
 - c. H₂O
 - d. both b and c**
- _____ 58. What is the final electron acceptor in the electron transport chain?
- a. hydrogen
 - b. oxygen**
 - c. water
 - d. both a and b
- _____ 59. What is the net ATP generally produced by the electron transport chain?
- a. 34 ATP**
 - b. 36 ATP
 - c. 38 ATP
 - d. none of the above
- _____ 60. Which of the following molecules can form ATP through oxidative phosphorylation?
- a. FAD
 - b. NADH**
 - c. H₂O
 - d. all of the above
- _____ 61. How many steps compose the citric acid cycle?
- a. six
 - b. seven
 - c. eight**
 - d. nine
- _____ 62. What is the maximum net ATP theoretically produced by cellular respiration?
- a. 34 ATP
 - b. 36 ATP
 - c. 38 ATP**
 - d. none of the above

- _____ 63. What are the waste products of cellular respiration?
- a. **H₂O and CO₂**
 - b. ADP and P_i
 - c. NADH and FADH₂
 - d. none of the above
- _____ 64. Lactic acid fermentation occurs in which type of human cell?
- a. bacteria
 - b. **skeletal muscle**
 - c. connective tissue
 - d. all of the above
- _____ 65. Which of the following is not a function of enzymes?
- a. aiding in digestion
 - b. breaking down molecules
 - c. working as reagents
 - d. **none of the above**
- _____ 66. How does an enzyme function as a catalyst in a biochemical reaction?
- a. increases the temperature required for a reaction to take place
 - b. **offers an alternative pathway of lower activation energy for a reaction**
 - c. weakens bonds within the molecules involved in a reaction
 - d. provides an active site of greater size for a substrate during a reaction
- _____ 67. What is the result of a substrate sufficiently colliding with an enzyme?
- a. enzyme-substrate complex forms
 - b. intermediate substance forms
 - c. end products form
 - d. **both a and b**
- _____ 68. How many separate reactions take place during a general enzyme-catalyzed reaction?
- a. one
 - b. **two**
 - c. three
 - d. four
- _____ 69. Which of the following is not an example of a non-protein cofactor of an enzyme?
- a. metal ions
 - b. prosthetic groups
 - c. activators
 - d. **none of the above**

- _____ 70. Coenzymes are typically what type of molecule?
- a. hormones
 - b. steroids
 - c. vitamins**
 - d. any of the above
- _____ 71. What does a competitive inhibitor do to an enzyme?
- a. distorts its shape
 - b. attaches to its outside
 - c. occupies its active site**
 - d. either a or c
- _____ 72. Which of the following factors affects the functionality of enzymes?
- a. pH level
 - b. enzyme concentration
 - c. substrate concentration
 - d. all of the above**
- _____ 73. Which of the following occurs during the longest phase of cell cycle?
- a. DNA replicates
 - b. chromatin condenses
 - c. chromosomes align
 - d. none of the above**
- _____ 74. During which phase of cell cycle is centrosome replication complete?
- a. G₁
 - b. G₂**
 - c. S
 - d. M
- _____ 75. Which phase of cell cycle is not part of interphase?
- a. G₁
 - b. G₂
 - c. S
 - d. M**
- _____ 76. How long does cell cycle usually take in a rapidly proliferating human cell?
- a. 4-6 hours
 - b. 10-12 hours
 - c. 14-16 hours
 - d. none of the above**

- _____ 77. Genome size would affect the duration of which of the following phases?
- a. G₁
 - b. G₂
 - c. S**
 - d. M
- _____ 78. Cells identified to have errors through cell cycle checkpoints usually undergo what?
- a. apoptosis**
 - b. necrosis
 - c. oncogenesis
 - d. none of the above
- _____ 79. Genetic mutations that result in uncontrolled cell division usually lead to what?
- a. necrosis
 - b. oncogenesis**
 - c. apoptosis
 - d. none of the above
- _____ 80. Which of the following is not a characteristic of interphase?
- a. the cell is metabolically active
 - b. cell growth occurs continually
 - c. organelles are duplicated
 - d. none of the above**
- _____ 81. Interphase accounts for approximately what percentage of cell cycle?
- a. 55-65%
 - b. 65-75%
 - c. 75-85%**
 - d. 85-95%
- _____ 82. Which of the following correctly orders the phases of mitosis?
- a. prophase → anaphase → metaphase → telophase
 - b. prophase → metaphase → telophase → anaphase
 - c. prophase → telophase → anaphase → metaphase
 - d. prophase → metaphase → anaphase → telophase**
- _____ 83. What occurs during prophase?
- a. chromatin condenses
 - b. spindle fibers appear
 - c. chromosomes align
 - d. both a and b**

- _____ 84. Which of the following does not occur during telophase?
- a. daughter chromosomes reach poles
 - b. sister chromatids separate**
 - c. two nuclei are formed
 - d. none of the above
- _____ 85. Chromosomes become aligned on the equatorial plane during which phase of mitosis?
- a. anaphase
 - b. metaphase**
 - c. prophase
 - d. telophase
- _____ 86. What is the function of centrioles in mitosis?
- a. formation of spindle fibers**
 - b. breaking down the nuclear envelope
 - c. condensing chromatin in the nucleus
 - d. both a and c
- _____ 87. What attaches to kinetochores during mitosis?
- a. sister chromatids
 - b. daughter chromosomes
 - c. centrosomes
 - d. none of the above**
- _____ 88. What culminates cell division?
- a. metaphase
 - b. telophase
 - c. anaphase
 - d. none of the above**
- _____ 89. Meiosis essentially repeats which of the following processes twice?
- a. transcription
 - b. replication
 - c. mitosis**
 - d. both b and c
- _____ 90. Which of the following statements summarizes meiosis I?
- a. sister chromatids separate while homologous chromosomes stay attached
 - b. daughter chromosomes separate while homologous chromosomes stay attached
 - c. homologous chromosomes separate while sister chromatids stay attached**
 - d. sister chromatids separate while daughter chromosomes stay attached

- _____ 91. Meiosis II involves the segregation of which of the following?
- a. sister chromatids**
 - b. homologous chromosomes
 - c. daughter chromosomes
 - d. all of the above
- _____ 92. What is the product of meiosis II?
- a. four daughter cells
 - b. four haploid cells
 - c. four gametes
 - d. all of the above**
- _____ 93. How many chromosomes are present in each human cell produced from meiosis?
- a. 22
 - b. 23**
 - c. 24
 - d. 26
- _____ 94. Which of the following is not a valid similarity between DNA and RNA?
- a. both run 5' to 3'
 - b. both have antiparallel structure**
 - c. both have sugar-phosphate backbones
 - d. none of the above
- _____ 95. Which of the following is a product of the reaction catalyzed by DNA polymerase?
- a. diphosphate**
 - b. deoxynucleoside triphosphate
 - c. single nucleic acid strand
 - d. both a and c
- _____ 96. Which of the following enzymes is necessary in transcription?
- a. RNA polymerase**
 - b. DNA polymerase
 - c. all of the above
 - d. none of the above
- _____ 97. Which of the following organelles contains DNA?
- a. mitochondrion**
 - b. smooth endoplasmic reticulum
 - c. Golgi apparatus
 - d. all of the above

- _____ 98. What type of RNA is required for translation?
- a. mRNA
 - b. rRNA
 - c. tRNA
 - d. all of the above**
- _____ 99. What does tRNA bind its anticodon to when performing its function in the cell?
- a. its complementary codon on mRNA**
 - b. its complementary codon on rRNA
 - c. its specific amino acid
 - d. both b and c
- _____ 100. Where is snRNA found in the cell?
- a. cytoplasm
 - b. mitochondria
 - c. nucleus**
 - d. all of the above
- _____ 101. Which of the following is a characteristic an individual receives from their parents?
- a. allele
 - b. trait**
 - c. gene
 - d. phenotype
- _____ 102. What is a chart of metaphase chromosomes called?
- a. genotype
 - b. karyotype**
 - c. pedigree
 - d. either b or c
- _____ 103. What does it mean when a gene is homozygous?
- a. both alleles are dominant
 - b. both alleles are recessive
 - c. one allele is dominant while the other is recessive
 - d. either a or b**
- _____ 104. Which of the following is not one of Mendel's Laws of Heredity?
- a. Law of Dominance
 - b. Law of Independent Assortment
 - c. Law of Nondisjunction**
 - d. none of the above

105. What does the Law of Dominance state?

- a. **dominant allele prevents recessive allele from being expressed**
- b. dominant allele only expressed when paired with another dominant allele
- c. codominance allows alleles to be expressed equally
- d. all of the above

106. Which pair of chromosomes are the gonosomes?

- a. 1st
- b. 17th
- c. 22nd
- d. **23rd**

107. Which of the following chromosome pairs would be found in a human male?

- a. XX
- b. **XY**
- c. YX
- d. YY

108. Which of the following is a polygenic trait?

- a. eye color
- b. hair color
- c. height
- d. **all of the above**

109. What type of genetic mutation results in protein synthesis stopping prematurely?

- a. missense
- b. frameshift
- c. **nonsense**
- d. both a and c

110. What type of microorganism cannot reproduce without a host cell?

- a. bacterium
- b. **virus**
- c. protozoan
- d. all of the above

111. What type of infectious organism is always unicellular?

- a. parasite
- b. **bacterium**
- c. virus
- d. both b and c

- _____ 112. Which of the following is not considered to be a type of pathogen?
- a. fungi
 - b. bacteria
 - c. viruses
 - d. none of the above**
- _____ 113. Which of the following types of virus is most often responsible for the common cold?
- a. rhinovirus**
 - b. adenovirus
 - c. coronavirus
 - d. norovirus
- _____ 114. Which of the following conditions is caused by bacteria?
- a. strep throat**
 - b. influenza
 - c. malaria
 - d. none of the above
- _____ 115. Why are some bacteria resistant to antibiotics?
- a. genetic mutation
 - b. specific enzymes
 - c. weak potency
 - d. both a and b**
- _____ 116. Which of the following is not a part of the first line of immune defense?
- a. mucous membranes
 - b. integument
 - c. pancreatic enzymes
 - d. blood cells**
- _____ 117. The second line of immune defense can be characterized by what?
- a. inflammation
 - b. fever
 - c. body aches
 - d. all of the above**
- _____ 118. What line of immune defense begins specific response?
- a. first
 - b. second
 - c. third**
 - d. fourth

_____ 119. Which of the following is not a type of phagocyte?

- a. neutrophil
- b. macrophage
- c. natural killer cell
- d. none of the above**

_____ 120. Humoral immunity involves which type of cell?

- a. T cells
- b. B cells**
- c. antigens
- d. all of the above