亞洲大學

110 學年度學士後獸醫學系招生考試試題紙

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學士後獸醫學系	生物化學	110.05.01	13:30-15:00

1. Arginine has the following p*K*a values: pK_1 = 2.17, pK_2 = 9.04, pK_R = 12.48
   Give the net charge of arginine at pH = 4 and 7
   A. +1 and +1 **B.** 0 and 0 **C.** 0 and +1 **D.** +2 and +1

2. Which amino acid is **NOT** hydrophobic?
   A. Tryptophan **B.** Tyrosine **C.** Proline **D.** Isoleucine

3. Aspartic acid has the following p*K*a values: pK_1 = 2.1, pK_2 = 9.8, pK_R = 3.9
   Which is the isoelectric point of aspartic acid?
   A. 3.0 **B.** 5.95 **C.** 6.85 **D.** 5.27

4. Which protein structure provides strength to connective tissues?
   A. Hemoglobin **B.** Collagen **C.** Albumin **D.** Gamma globulin

5. Which protein is required for protein folding?
   A. Alpha globulin **B.** Beta globulin **C.** Chaperone **D.** Isomerase

6. Which protein is involved in the pathogenesis of Alzheimer's disease?
   A. Albumin **B.** Amyloid **C.** Hemoglobin **D.** Myoglobin

7. Which iron state of heme can bind oxygen reversibly?
   A. Fe^{2+} **B.** Fe^{3+} **C.** Fe^{4+} **D.** None of above

8. Which subunit of hemoglobin has a single amino acid substitution (Glu^6 to Val^6) that causes Sickle cell anemia?
   A. Alpha **B.** Beta **C.** Gamma **D.** Delta

9. Which ion released from the sarcoplasmic reticulum can stimulate muscle contraction?
   A. Zn^{2+} **B.** Mg^{2+} **C.** Ca^{2+} **D.** Na^{+}

10. Which amino acid of glycogen phosphorylase is phosphorylated at its hydroxyl group for activation?
    A. Tyrosine **B.** Threonine **C.** Serine **D.** Homoserine

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11. By which enzyme cleavage is π -chymotrypsin generated?
A. Papain **B.** Trypsin **C.** Casein **D.** Enteropeptidase

12. Which description of the "Michaelis-Menten equation" is **NOT** correct?
A. K_m = [S], when V_0 = 1/2 V_{max}
B. K_m << [S], when V_0 = V_{max}
C. High values of K_m correspond to low enzyme affinity for substrate
D. High value of [S] correspond to high enzyme affinity for substrate

13. Which of the following carbohydrates are reducing?
a. Starch; b. Cellulose; c. Fructose; d. Sucrose; e. Ribose
A. ab **B.** bc **C.** de **D.** ce

14. Which of the following carbohydrates are non-reducing?
a. Glucose; b. Fructose; c. □-Methyl-D-glucoside; d. Lactose; e. Sucrose
A. ab **B.** cd **C.** ce **D.** bc

15. In glucosamine, at which carbon's hydroxyl group of the parent compound is replaced with an amino group?
A. C-1 **B.** C-2 **C.** C-3 **D.** C-4

16. Which clinical parameter can be used for monitoring diabetes?
A. Myoglobin glycation
B. Hemoglobin glycation
C. Albumin glycation
D. Alpha-globulin glycation

17. Provide the RNA transcription product for the following DNA sequence:
5'-AGGGGCCGTTATCGTT-3'
A. 5'-AACGATAACGGCCCCT-3'
B. 5'-AGGGGCCGUUAUCGUU-3'
C. 5'-AACGAUAACGGCCCCU-3'
D. 5'-UUCGAUAACGGCCCCU-3'

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18. With more of which base-pair content will a DNA sample be stable?
A. GC **B.** AT **C.** AU **D.** GT

19. Which form of DNA is the most stable structure under physiological conditions?
A. A form **B.** B form **C.** C form **D.** Z form

20. In which part of an animal cell can we find RNA?
A. Nucleus **B.** Cytoplasm **C.** Mitochondria **D.** All of above

21. What does "SNP" mean?
A. A genomic base-pair change that helps distinguish one species from another
B. A type of genetic recombination that occurs only at specific sequences
C. A superfamily of N proteins
D. An RNA hybridization procedure

22. What is a "Haplotype"?
A. A set of DNA variations that tend to be inherited together on a chromosome
B. A set of genotypes on homologous chromosome pairs in the population
C. A set of phenotypes on a chromosome in the population
D. A set of all DNA variations on both chromosomes

23. What is a "cDNA library"?
A. A collection of peptide fragments derived from the genomic DNA in an organism or cell type under a defined set of conditions.
B. A collection of complementary DNA fragments derived from the complement of tRNA expressed in a particular organism or cell type under a defined set of conditions.
C. A collection of cloned DNA fragments derived from the complement of mRNA expressed in a particular organism or cell type under a defined set of conditions.
D. A collection of cloned RNA fragments derived from the complement strand of a particular DNA in an organism or cell type under a defined set of conditions.

24. In which organism can we find the "Restriction modification system"?
A. Bacteria **B.** Viruses **C.** Animals **D.** All of above

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25. How many fatty acid molecules does a triacylglycerol have?
A. 1 **B.** 2 **C.** 3 **D.** None of above

26. Which description of omega-3 (ω-3) fatty acids is correct?
A. A double bond between C-2 and C-3 (relative to the ω carbon)
B. A double bond between C-3 and C-4 (relative to the ω carbon)
C. Two double bonds between C-2, C-3 and C-4 (relative to the ω carbon)
D. None of above

27. Which description of eicosapentaenoic acid (EPA; 20:5 ($\square^{5,8,11,14,17}$), is correct?
A. An omega-3 fatty acid
B. An omega-5 fatty acid
C. A saturated fatty acid
D. None of above

28. Which description of "lipase" is correct?
A. Catalyzing the hydrolysis of unsaturated fatty acids
B. Catalyzing the hydrolysis of triacylglycerol
C. Catalyzing the hydrolysis of saturated fatty acids
D. All of above

29. Which description of Sphingomyelins is **NOT** correct?
A. An amphipathic molecule
B. The polar region containing ester and amide is hydrophilic
C. The hydrocarbon tail is hydrophobic
D. None of above

30. By which cellular component are gangliosides degraded?
A. Endoplasmic reticulum **B.** Peroxisome **C.** Lysosome **D.** None of above

31. Which phospholipase is responsible for the hydrolysis of Phosphatidylinositol 4,5-Bisphosphate (PIP_2) to release inositol 1,4,5-Trisphosphate (IP_3) and diacylglycerol (DAG)?
A. Phospholipase A **B.** Phospholipase B **C.** Phospholipase C **D.** None of above

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32. Which description of prostaglandins (PG) is correct?
A. PGE_2 and other series 2 prostaglandins are synthesized from arachidonate.
B. Series 2 prostaglandins are derived from EPA.
C. Some PGs trigger dilation of the smooth muscle of the uterus during menstruation and labor.
D. None of above

33. Which description of "Tumor suppressor genes" is correct?
A. Encode proteins that normally restrain cell division.
B. Mutation in one or more of these genes can lead to tumor formation.
C. *Rb* and *p53* are tumor repressor genes.
D. All of above

34. Which description of "Apoptosis signaling" is correct?
A. Caspase 8 plays a pivotal role in the intrinsic apoptotic signaling pathway.
B. Caspase 9 plays a pivotal role in the extrinsic apoptotic signaling pathway.
C. The release of cytochrome c initiates the intrinsic pathway of apoptosis.
D. None of above

35. Which description of *Apc* (adenomatous polyposis coli) gene is **NOT** correct?
A. A tumor suppressor gene
B. Mutation of *Apc* results in the formation of colon polyps or colorectal cancers.
C. *Apc* mutation in mice may result in severe anemia.
D. None of above

36. Which enzyme can allosterically regulate glycolysis?
A. Hexokinase **B.** Phosphofructokinase-1 **C.** Pyruvate kinase **D.** All of above

37. Which description of glycogen synthesis is **NOT** correct?
A. Glycogen synthesis mainly happen in the liver.
B. Glycogen synthesis required glycogen phosphorylase and branching enzyme.
C. Glucose-6-phosphate is converted to glucose-1-phosphate by phosphoglucomutase.
D. The substrate for glycogen synthesis is UDP-glucose.

38. Which description of gluconeogenesis is **NOT** correct?
    A. Glucose molecules are synthesized from non-carbohydrate precursors.
    B. The reaction of gluconeogenesis is totally the reverse of glycolysis.
    C. Fructose-1,6-bispohosphate is converted to fructose-6-phosphate by fructose bisphosphate phosphatase.
    D. Glucose-6-phosphate is converted to glucose by Glucose-6-phosphatase.

39. Which description of acetyl-CoA is correct?
    A. Pyruvate is converted to acetyl-CoA, which then enters the citric acid cycle.
    B. Acetyl-CoA cannot be transported directly across the mitochondrial membrane.
    C. During the citric acid cycle, acetyl-CoA transfers its acetyl group to oxaloacetate to form citrate.
    D. All of above

40. Glutamine is degraded to form NH_4^+, CO_2 and H_2O. How many molecules of ATP can be generated from 1 mole of glutamine? (assuming that each NADH yields 2.5 ATP and each $FADH_2$ yields 1.5 ATP)?
    A. 23.5 **B.** 25.5 **C.** 27.5 **D.** 30

41. Which description is **NOT** correct about cellular foundations?
    A. All cells are bounded by a plasma membrane.
    B. All organisms require a source of energy to perform cellular work.
    C. Bacterial and archaeal cells contain a nucleus.
    D. Eukaryotic cells are multi-compartmented, with certain processes segregated in specific organelles.

42. Which of the following elements is essential to be structural components of cells and tissues in animal life?
    A. Silicon (Si) **B.** Helium (He) **C.** Carbon (C) **D.** Hydrargyrum (Hg)

43. The human red blood cells burst when they are placed in the water. Which of the following will cause *Escherichia coli* (*E. coli*) to burst completely in it?
    A. Isotonic solution **B.** Hypertonic solution
    C. Hypotonic solution **D.** None of above

44. The phosphate buffer system is maximally effective at a pH close to its p*K*a of 6.86 and thus tends to resist pH changes in the range between about 5.9 and 7.9. What is the pH of a mixture of 0.05 M NaH_2PO_4 and 0.5 M Na_2HPO_4?
A. 5.86 **B.** 6.86 **C.** 7 **D.** 7.86

45. How many cycles of β-oxidation are required to completely process a saturated stearic acid (C18)?
A. 7 **B.** 8 **C.** 9 **D.** 18

46. The β-oxidation of saturated fatty acids has four basic steps. The important enzymes involved in the reaction are listed below:
1. enoyl-CoA hydratase 2. acyl-CoA dehydrogenase 3. β-hydroxyacyl-CoA dehydrogenase 4. acyl-CoA acetyltransferase
Which of the following is the correct order that they react in the β-oxidation pathway?
A. 1234 **B.** 4321 **C.** 2134 **D.** 3421

47. Which of the following is **NOT** a ketone body?
A. Acetyl-CoA **B.** Acetone **C.** β-hydroxybutyrate **D.** Acetoacetate

48. Which description is **NOT** correct about the catabolism of amino acids?
A. An early step in the catabolism of amino acids is the separation of the amino group from the carbon skeleton.
B. The amino group is transferred to α-ketoglutarate to form glutamate.
C. The amino group transamination reaction requires the coenzyme pyridoxal phosphate.
D. Glutamate dehydrogenase liberates the amino group as ammonium ion (NH_4^+) in the liver peroxisome.

49. Which of the following hormones is derived from cholesterol?
A. Progesterone **B.** Androgens **C.** Estrogens **D.** All of the above

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50. Which description is **NOT** correct about the nitrogen excretion?
A. Ammonia is highly toxic to animal tissues.
B. In the urea cycle, ornithine combines with ammonia and regenerate in each turn of the cycle.
C. The urea cycle results in a net conversion of fumarate to oxaloacetate.
D. Both of fumarate and oxaloacetate are intermediates in the TCA cycle.

51. Which of the following enzymes is regulated by allosteric regulation in the urea cycle?
A. Carbamoyl phosphate synthetase I
B. Glutamine synthetase
C. Glutamate dehydrogenase
D. Aspartate aminotransferase

52. Which of the following is an alternative electron donor to the mitochondrial electron transport chain?
A. H_2O **B.** Succinate **C.** Fumarate **D.** All of the above

53. Which of the following metabolic reactions mainly occur in the mitochondrial matrix?
A. Gluconeogenesis
B. Pentose phosphate pathway
C. Citric acid cycle
D. Glycolysis

54. Which of the following intermediates is key connection of carbohydrate, protein, and lipid metabolic pathways?
A. Triglyceride **B.** Pyruvate **C.** Acetyl-CoA **D.** Adenosine triphosphate

55. What is the first enzyme in glycolysis?
A. Phosphoglycerate Kinase **B.** Enolase **C.** Pyruvate Kinase **D.** Hexokinase

56. Which of the following enzymes is related to the CO_2-assimilating reactions (Calvin cycle) in plants?
A. Aldolase **B.** Transketolase **C.** Rubisco **D.** Hexokinase

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57. Many bacteria have thick, rigid extracellular walls that protect them from osmotic lysis. Which of the following is **NOT** found in the cell wall of gram-positive bacteria?
A. Pentaglycine **B.** *N*-Acetylglucosamine **C.** *N*-Acetylmuramic acid **D.** Cellulose

58. Where does the pentose phosphate pathway occur in the cells?
A. Cytosol **B.** Mitochondria **C.** Endoplasmic reticulum **D.** Peroxisome

59. Which of the following is a major storage form of lipid in animals?
A. Cholesterol **B.** Sphingolipid **C.** Phospholipid **D.** Triacylglycerol

60. Which of the following is necessary for long-chain saturated fatty acids biosynthesis?
A. Acetyl-CoA **B.** Acyl carrier protein **C.** Fatty acid synthase **D.** All of the above

61. What is the final product of fatty acid synthesis?
A. Palmitate **B.** Stearic acid **C.** Oleic acid **D.** None of above

62. Eicosanoids are locally acting signaling molecules, controlling numerous important homeostatic and inflammatory processes. Which of the following is the parent compound of eicosanoids?
A. Leukotriene **B.** Thromboxane **C.** Prostaglandin **D.** All of the above

63. In living systems, reduced nitrogen is incorporated first into amino acids and then into a variety of other biomolecules. Which of the following amino acids is the key entry point?
A. Glycine **B.** Glutamate **C.** Arginine **D.** Serine

64. Which of the following amino acids is the precursor of glycine?
A. Glycine **B.** Glutamate **C.** Arginine **D.** Serine

65. Degradation of iron-porphyrin (heme) generates bilirubin, which is converted to bile pigments with several physiological functions. Which of the following amino acids is the precursor of porphyrins?
A. Glycine **B.** Glutamate **C.** Arginine **D.** Serine

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66. Which of the following amino acids is the precursor of nitric oxide, a biological messenger?
A. Glycine **B.** Glutamate **C.** Arginine **D.** Serine

67. Which of the following biochemical methods is **NOT** related to antibodies?
A. Immunoprecipitation
B. Western blot
C. Enzyme-linked immunosorbent assay
D. SDS-PAGE

68. Which of the following hormones bind to specific receptors in the membrane of target cells without actually entering the cell?
A. Eicosanoid hormones **B.** Steroid hormones **C.** Retinoid **D.** Thyroid hormones

69. Which of the following molecular is the key intermediate in glucose metabolism and lies at the crossroads of different metabolic pathways including glycogen synthesis, glycolysis, and pentose phosphate pathway?
A. Ribose-5-phosphate **B.** Glucose 6-phosphate
C. Fructose 1-phosphate **D.** Glyceraldehyde 3-phosphate

70. Most cellular DNAs are supercoiled. What is the relation between writing number (Wr), linking number (Lk) and twist number (Tw)?
A. Lk=Tw+Wr **B.** Lk=Tw-Wr **C.** Lk=Wr-Tw **D.** Tw=Lk+Wr

71. Which of the following specialized regions on the chromosome plays a critical role in the even distribution of parental DNA during cell division?
A. Introns **B.** Exons **C.** Centromere **D.** Telomere

72. Which kind of mechanism is **NOT** included in the central dogma of molecular biology?
A. Replication **B.** Transcription **C.** Denaturation **D.** Translation

73. Which of the following is a method of sequencing amino acids in a peptide?
A. Edman degradation **B.** Polymerase chain reaction
C. Ultracentrifugation **D.** X-ray crystallography

74. Which of the following is the most common start codon for protein synthesis in eukaryotes?
A. UAA **B.** UAG **C.** UGA **D.** AUG

75. Which description is **NOT** correct about DNA replication?
A. Replication of DNA occurs with very high fidelity.
B. DNA replication is semiconservative.
C. DNA is synthesized in the 5'→3' direction by DNA polymerases.
D. The leading strand continuously of DNA replication is formed by the Okazaki fragments.

76. Which of the following is **NOT** a type of RNA processing?
A. Capping of the 5' end of RNA
B. Polyadenylation of the 3' end of the RNA
C. Splicing for removing the exons
D. None of above

77. Which of the following are ketogenic amino acid?
A. Arg, Pro **B.** Ile, Met **C.** Phe, Tyr **D.** Leu, Lys

78. What kind of immunoglobulin is the major type of antibody in the blood, lymph fluid, cerebrospinal fluid, and peritoneal fluid?
A. IgG **B.** IgA **C.** IgM **D.** IgY

79. Which complex in the respiratory chain is inhibited by rotenone?
A. Complex I **B.** Complex II **C.** Complex III **D.** Complex VI

80. Moderna COVID-19 vaccine is a type of ribonucleic acid (RNA) vaccine. What type of RNA is its primary active compounds?
A. tRNA **B.** mRNA **C.** rRNA **D.** snRNA