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114 學年度學士後獸醫學系招生試題紙

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學士後獸醫學系	生物化學	**114.04.26**	**13:30-15:00**

1. Which of the following correctly describes the net yield of ATP equivalents during complete oxidation of one molecule of palmitate (C16:0) under aerobic conditions?
   A) 96 ATP
   B) 106 ATP
   C) 129 ATP
   D) 148 ATP

2. In the TCA cycle, which enzyme catalyzes a reaction that directly produces GTP (or ATP) via substrate-level phosphorylation?
   A) Isocitrate dehydrogenase
   B) α-Ketoglutarate dehydrogenase
   C) Succinyl-CoA synthetase
   D) Malate dehydrogenase

3. Which of the following is NOT a regulatory mechanism of pyruvate dehydrogenase (PDH) complex activity?
   A) Inhibition by acetyl-CoA
   B) Phosphorylation by PDH kinase
   C) Allosteric activation by cAMP
   D) Stimulation by NAD+

4. During prolonged fasting, gluconeogenesis is critical for maintaining blood glucose. Which enzyme bypasses the irreversible step of glycolysis catalyzed by pyruvate kinase?
   A) Pyruvate carboxylase
   B) Phosphoenolpyruvate carboxykinase (PEPCK)
   C) Both A and B
   D) Fructose-1,6-bisphosphatase

5. The pentose phosphate pathway produces NADPH for biosynthetic reactions. Which enzyme is the major regulatory point of this pathway?
   A) Transketolase
   B) Glucose-6-phosphate dehydrogenase
   C) 6-Phosphogluconate dehydrogenase
   D) Ribulose-5-phosphate isomerase

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6. Which of the following correctly describes the role of carnitine in fatty acid metabolism?
   A) It activates fatty acids for β-oxidation
   B) It transports fatty acids into the mitochondrial matrix
   C) It inhibits acetyl-CoA carboxylase
   D) It is a cofactor for fatty acid synthase
7. In glycolysis, which enzyme catalyzes an irreversible reaction that is bypassed in gluconeogenesis by fructose-1,6-bisphosphatase?
   A) Hexokinase
   B) Phosphofructokinase-1 (PFK-1)
   C) Pyruvate kinase
   D) Aldolase
8. Which of the following is a key allosteric activator of phosphofructokinase-1 (PFK-1)?
   A) ATP
   B) Citrate
   C) AMP
   D) NADH
9. What is the primary function of the urea cycle?
   A) To generate ATP from amino acid catabolism
   B) To detoxify ammonia by converting it to urea
   C) To synthesize nonessential amino acids
   D) To produce ketone bodies
10. Which of the following is NOT a product of the TCA cycle?
    A) NADH
    B) $FADH_2$
    C) GTP
    D) Acetyl-CoA
11. Which enzyme is defective in phenylketonuria (PKU)?
    A) Phenylalanine hydroxylase
    B) Tyrosinase
    C) Homogentisate oxidase
    D) Alkaptonuria

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12. In glycogen metabolism, which enzyme is responsible for adding glucose units to a growing glycogen chain?
    A) Glycogen phosphorylase
    B) Glycogen synthase
    C) Debranching enzyme
    D) Phosphoglucomutase

13. Which of the following is a key regulatory enzyme in cholesterol biosynthesis?
    A) HMG-CoA reductase
    B) Acetyl-CoA carboxylase
    C) Fatty acid synthase
    D) Carnitine palmitoyltransferase

14. Which molecule is the final electron acceptor in the electron transport chain?
    A) NAD+
    B) FAD
    C) O_2
    D) Cytochrome c

15. Which of the following is a ketone body?
    A) Pyruvate
    B) Acetoacetate
    C) Lactate
    D) Succinate

16. Which vitamin is a precursor for NAD+ and NADP+?
    A) Thiamine (B_1)
    B) Riboflavin (B_2)
    C) Niacin (B_3)
    D) Pantothenic acid (B_5)

17. Which of the following inhibits glycolysis and stimulates gluconeogenesis?
    A) Insulin
    B) Glucagon
    C) High ATP levels
    D) Fructose-2,6-bisphosphate

18. Which enzyme is responsible for fixing CO_2 in the Calvin cycle?
    A) Rubisco
    B) PEP carboxylase
    C) Pyruvate carboxylase
    D) Carbonic anhydrase

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19. Which of the following is a product of anaerobic glycolysis in muscle cells?
    A) Ethanol
    B) Lactate
    C) Acetyl-CoA
    D) Oxaloacetate

20. Which hormone stimulates lipolysis in adipose tissue?
    A) Insulin
    B) Glucagon
    C) Leptin
    D) Adiponectin

21. A Lineweaver-Burk plot for an enzyme shows parallel lines for reactions with and without a competitive inhibitor. Which conclusion is correct?
    A) The inhibitor binds only to the ES complex
    B) The inhibitor changes the Vmax but not Km
    C) The experiment was performed incorrectly
    D) The inhibitor is noncompetitive

22. Which amino acid is MOST likely to act as a nucleophile in an enzyme's active site?
    A) Valine
    B) Serine
    C) Proline
    D) Leucine

23. An enzyme with a kcat of 500 s^{-1} and Km of 10 μM is studied. At [S] = 2 μM, what is the reaction velocity (v) as a fraction of Vmax?
    A) ~16.7%
    B) ~25%
    C) ~50%
    D) ~75%

24. Which type of enzyme inhibition is overcome by increasing substrate concentration?
    A) Competitive
    B) Noncompetitive
    C) Uncompetitive
    D) Mixed

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25. Which of the following is NOT a mechanism of enzyme regulation?
    A) Allosteric modulation
    B) Covalent modification
    C) Proteolytic cleavage
    D) Denaturation at high temperatures

26. A protease that cleaves peptide bonds on the carboxyl side of aromatic amino acids has which type of specificity?
    A) Absolute
    B) Group
    C) Linkage
    D) Stereochemical

27. Which of the following is a coenzyme derived from vitamin B6 (pyridoxine)?
    A) Thiamine pyrophosphate
    B) Flavin adenine dinucleotide
    C) Pyridoxal phosphate
    D) Biotin

28. A reaction with a negative ΔG is best described as:
    A) Endergonic
    B) Exergonic
    C) At equilibrium
    D) Spontaneous in the reverse direction

29. Which of the following is a zymogen?
    A) Trypsin
    B) Trypsinogen
    C) Chymotrypsin
    D) Pepsin

30. Which enzyme class catalyzes oxidation-reduction reactions?
    A) Oxidoreductases
    B) Transferases
    C) Hydrolases
    D) Lyases

31. Which of the following conditions increases the rate of glycolysis in muscle cells?
    A) High ATP concentration
    B) Low AMP concentration
    C) High citrate levels
    D) High AMP concentration

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32. What is the primary function of the Cori cycle?
    A) To convert ammonia into urea
    B) To recycle lactate from muscles into glucose in the liver
    C) To oxidize fatty acids in muscle tissue
    D) To produce ketone bodies from acetyl-CoA

33. Which amino acid is commonly involved in covalent catalysis?
    A) Alanine
    B) Cysteine
    C) Glycine
    D) Phenylalanine

34. A reaction with a high Km value indicates:
    A) High enzyme efficiency
    B) Low substrate affinity
    C) High Vmax
    D) Irreversible inhibition

35. Which of the following is NOT a feature of enzyme active sites?
    A) Hydrophobic pockets
    B) Flexible structure
    C) High substrate specificity
    D) Permanent covalent binding to substrate

36. During DNA replication, the lagging strand is synthesized discontinuously as Okazaki fragments. Which enzyme is responsible for removing RNA primers and replacing them with DNA?
    A) DNA polymerase III
    B) DNA polymerase I
    C) DNA ligase
    D) Primase

37. A mutation in the TATA box of a eukaryotic promoter would most directly affect:
    A) Translation initiation
    B) Transcription termination
    C) Binding of RNA polymerase II
    D) Splicing efficiency

38. Which post-translational modification is most commonly involved in signaling protein degradation?
    A) Phosphorylation　B) Ubiquitination　C) Glycosylation　D) Acetylation

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39. The wobble hypothesis explains:
    A) DNA polymerase proofreading
    B) Degeneracy in the genetic code
    C) Ribosome translocation
    D) tRNA anticodon flexibility

40. Which repair mechanism fixes thymine dimers caused by UV radiation?
    A) Base excision repair
    B) Nucleotide excision repair
    C) Mismatch repair
    D) Non-homologous end joining

41. What is the function of the σ factor in bacterial transcription?
    A) Terminate transcription
    B) Initiate ribosome binding
    C) Recognize promoter sequences
    D) Proofread RNA synthesis

42. Alternative splicing allows:
    A) One gene to produce multiple proteins
    B) DNA replication without primers
    C) Ribosomes to switch reading frames
    D) tRNAs to recognize multiple codons

43. Which enzyme adds telomeric repeats to chromosome ends?
    A) DNA polymerase δ
    B) Telomerase
    C) Topoisomerase II
    D) Helicase

44. The Shine-Dalgarno sequence is important for:
    A) Eukaryotic transcription initiation
    B) Prokaryotic translation initiation
    C) RNA splicing
    D) Protein folding

45. What is the function of aminoacyl-tRNA synthetases?
    A) Charge tRNAs with correct amino acids
    B) Synthesize rRNA
    C) Degrade misfolded proteins
    D) Modify histones

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46. Which component is NOT part of the eukaryotic transcription initiation complex?
    A) TBP
    B) TFIIH
    C) Sigma factor
    D) Mediator

47. What does reverse transcriptase produce from an RNA template?
    A) cDNA
    B) rRNA
    C) siRNA
    D) mRNA

48. The polyA tail of eukaryotic mRNA is important for:
    A) Transcription initiation
    B) Nuclear export and stability
    C) Ribosome binding
    D) Splicing

49. Which process requires a primer to begin synthesis?
    A) Transcription
    B) Translation
    C) DNA replication
    D) Protein folding

50. What is the function of chaperone proteins?
    A) Degrade misfolded proteins
    B) Assist protein folding
    C) Modify DNA structure
    D) Synthesize RNA

51. Which enzyme is defective in xeroderma pigmentosum?
    A) DNA glycosylase
    B) Nucleotide excision repair enzyme
    C) DNA ligase
    D) Telomerase

52. RNA interference (RNAi) involves:
    A) siRNA-mediated mRNA degradation
    B) rRNA processing
    C) tRNA modification
    D) mRNA capping

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53. The lac operon is repressed when:
    A) Lactose is present
    B) Glucose is absent
    C) Glucose is present
    D) cAMP levels are high

54. Which modification occurs to eukaryotic mRNA after transcription?
    A) 5' capping
    B) Polyadenylation
    C) Splicing
    D) All of the above

55. What is the function of the nucleolus?
    A) rRNA synthesis and ribosome assembly
    B) DNA replication
    C) Protein degradation
    D) mRNA processing

56. Which level of protein structure is primarily stabilized by hydrogen bonds between backbone amides?
    A) Primary
    B) Secondary
    C) Tertiary
    D) Quaternary

57. Myoglobin and hemoglobin differ in oxygen binding properties because:
    A) Myoglobin lacks heme
    B) Hemoglobin exhibits cooperative binding
    C) Myoglobin has higher p50
    D) Hemoglobin cannot bind CO_2

58. Which technique would best determine a protein's tertiary structure?
    A) SDS-PAGE
    B) X-ray crystallography
    C) Western blot
    D) PCR

59. The Bohr effect describes:
    A) pH influence on hemoglobin oxygen affinity
    B) Temperature effects on enzyme activity
    C) Salt concentration on protein solubility
    D) Pressure effects on reaction rates

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60. Which amino acid is most likely to be found in a β-turn?
    A) Glycine
    B) Tryptophan
    C) Glutamate
    D) Phenylalanine

61. Disulfide bonds are most important for stabilizing:
    A) α-helices
    B) β-sheets
    C) Tertiary structure
    D) Primary structure

62. Which amino acid substitution would most likely disrupt an α-helix?
    A) Leu → Val
    B) Glu → Asp
    C) Pro → Ala
    D) Lys → Arg

63. The Hill coefficient measures:
    A) Enzyme catalytic efficiency
    B) Cooperativity in ligand binding
    C) Protein stability
    D) Reaction velocity

64. Which protein is an example of a motor protein?
    A) Actin
    B) Myosin
    C) Tubulin
    D) Keratin

65. Prion diseases result from:
    A) Viral infection
    B) Misfolded proteins
    C) DNA mutations
    D) RNA degradation

66. Anfinsen's experiment with ribonuclease demonstrated:
    A) Protein denaturation is irreversible
    B) Primary structure determines tertiary structure
    C) Chaperones are required for folding
    D) Disulfide bonds are unnecessary

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67. Which amino acid can form hydrogen bonds via its side chain?
    A) Alanine
    B) Serine
    C) Valine
    D) Leucine

68. The proteasome primarily degrades:
    A) Glycogen
    B) Ubiquitinated proteins
    C) Phospholipids
    D) Nucleic acids

69. Which protein structure prediction method uses known structures as templates?
    A) Ab initio modeling
    B) Homology modeling
    C) Threading
    D) Molecular dynamics

70. Zinc finger motifs are examples of:
    A) DNA-binding domains
    B) Enzyme active sites
    C) Membrane channels
    D) Chaperone proteins

71. Cardiolipin is a unique phospholipid found predominantly in:
    A) Lysosomes
    B) Mitochondrial inner membrane
    C) Plasma membrane
    D) Golgi apparatus

72. Which lipid-soluble molecule acts as a second messenger by activating protein kinase C?
    A) IP_3
    B) Diacylglycerol (DAG)
    C) cAMP
    D) Calcium ions

73. The fluid mosaic model describes:
    A) DNA structure
    B) Membrane structure
    C) Protein folding
    D) Enzyme kinetics

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74. Which transport mechanism requires ATP directly?
    A) Facilitated diffusion
    B) Primary active transport
    C) Secondary active transport
    D) Simple diffusion

75. Lipid rafts are enriched in:
    A) Cholesterol and sphingolipids
    B) Phosphatidylcholine
    C) Triglycerides
    D) Free fatty acids

76. The sodium-potassium pump moves:
    A) 2 Na^+ out, 3 K^+ in per ATP
    B) 3 Na^+ out, 2 K^+ in per ATP
    C) 2 Na^+ in, 3 K^+ out per ATP
    D) 3 Na^+ in, 2 K^+ out per ATP

77. Which vitamin is essential for blood clotting?
    A) Vitamin A
    B) Vitamin K
    C) Vitamin E
    D) Vitamin D

78. Membrane potential is primarily maintained by:
    A) Na^+/K^+ ATPase
    B) GLUT transporters
    C) Aquaporins
    D) Gap junctions

79. Which lipid is a precursor for steroid hormones?
    A) Phosphatidylcholine
    B) Cholesterol
    C) Sphingomyelin
    D) Ganglioside

80. The major phospholipid in eukaryotic cell membranes is:
    A) Phosphatidylserine
    B) Phosphatidylcholine
    C) Phosphatidylethanolamine
    D) Phosphatidylinositol