Part 1.  Enzymology and Biology Oxidation

1. CH₃-CH(OH)-CH₂-COOH → CH₃-CO-CH₂-COOH. The conversion of β-hydroxybutyrate to acetoacetate occurs by what type of reaction?
   a) reduction
   b) transfer
   c) oxidation
   d) dehydration
   e) dehydroxylation

2. What is the [H⁺] of a solution at physiologic pH (7.4)?
   a) -7.4
   b) 0.6
   c) 0.6×10⁻⁸
   d) 1.0×10⁻⁸
   e) 4.0×10⁻⁸

3. Proteins are effective buffers because they contain:
   a) a large number of amino acids
   b) amino acid residues with different pKs
   c) N-terminal and C-terminal residues that can donate and accept protons
   d) peptide bonds that readily hydrolyze, consuming hydrogen and hydroxyl ions
   e) a large number of hydrogen bonds in α-helices

4. (Asp-Ala-Ser-Glu-Val-Arg). The C-terminal amino acid of the hexapeptide shown is:
   a) alanine
   b) asparagine
   c) aspartate
   d) arginine

5. (Asp-Ala-Ser-Glu-Val-Arg). At physiologic pH (7.4) the net charge of this hexapeptide is:
   a) -2
   b) -1
   c) 0
   d) +1
   e) +2

6. Which one of the following types of bonds is covalent?
   a) hydrophobic
   b) hydrogen
   c) disulfide
   d) electrostatic
   e) Van der Waals

7. Production of which of the following proteins would be most directly affected in scurvy?
   a) myoglobin
   b) collagen
   c) insulin
   d) hemoglobin
   e) albumin

8. A competitive inhibitor of an enzyme...
   a) increases $K_m$ but does not affect $V_m$
   b) decreases $K_m$ but does not affect $V_m$
   c) decreases $V_m$ but does not affect $K_m$
d) decreases both $V_m$ and $K_m$

9. Which from the aminoacids is produced from two amino acids by an oxidation reaction?
   a) HOOC-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
   b) COOH-CH(NH$_2$)-CH$_2$-C$_6$H$_5$
   c) COOH-CH(NH$_2$)-CH$_2$-S-S-CH$_2$-CH(NH$_2$)-COOH
   d) CH$_3$-S-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
   e) HS-CH$_2$-CH(NH$_2$)-COOH

10. Which from the aminoacids contains an aromatic side chain?
    a) HOOC-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    b) COOH-CH(NH$_2$)-CH$_2$-C$_6$H$_5$
    c) COOH-CH(NH$_2$)-CH$_2$-S-S-CH$_2$-CH(NH$_2$)-COOH
    d) CH$_3$-S-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    e) HS-CH$_2$-CH(NH$_2$)-COOH

11. Which from the aminoacids contains a side chain that participates in electrostatic interactions?
    a) HOOC-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    b) COOH-CH(NH$_2$)-CH$_2$-C$_6$H$_5$
    c) COOH-CH(NH$_2$)-CH$_2$-S-S-CH$_2$-CH(NH$_2$)-COOH
    d) CH$_3$-S-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    e) CH$_3$-CH(NH$_2$)-COOH

12. Which from the aminoacids migrates toward the anode in an electric field?
    a) HOOC-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    b) COOH-CH(NH$_2$)-CH$_2$-C$_6$H$_5$
    c) COOH-CH(NH$_2$)-CH$_2$-S-S-CH$_2$-CH(NH$_2$)-COOH
    d) CH$_3$-S-CH$_2$-CH$_2$-CH(NH$_2$)-COOH
    e) CH$_3$-CH(NH$_2$)-COOH

13. This protein requires vitamin C for its synthesis:
    a) hemoglobin
    b) myoglobin
    c) collagen
    d) insulin
    e) albumin

14. This protein has one oxygen binding site and one polypeptide chain:
    a) hemoglobin
    b) myoglobin
    c) collagen
    d) insulin
    e) albumin

15. This protein contains four molecules of heme per molecule of protein:
    a) hemoglobin
    b) myoglobin
    c) collagen
    d) insulin
    e) albumin

16. This protein is converted into a triple helix during its synthesis:
    a) hemoglobin
    b) myoglobin
    c) collagen
17. This protein is composed of two polypeptide chains joined by disulfide bonds:
   a) hemoglobin
   b) myoglobin
   c) collagen
   d) insulin
   e) albumin

Part 2. "Biologic Oxidation"

18. If the enzyme concentration for a biochemical reaction is increased 100-fold, the equilibrium constant for the reaction will:
   a) decrease twofold
   b) remain the same
   c) increase in proportion to the enzyme concentration
   d) change inversely with the enzyme concentration

19. All of the following are electron carriers in the electron transport chain EXCEPT:
   a) cytochromes
   b) coenzyme Q
   c) Fe-S centers
   d) hemoglobin
   e) riboflavin

20. In the tricarboxylic acid cycle, thiamine pyrophosphate:
   a) accepts electrons from the oxidation of pyruvate and α-ketoglutarate
   b) accepts electrons from the oxidation of isocitrate
   c) forms a covalent intermediate with the α-carbon of α-ketoglutarate
   d) forms a thioester with the sulfhydryl group of CoASH
   e) forms a thioester with the sulfhydryl group of lipoic acid

21. Each of the following vitamins is required for reactions in the oxidation of pyruvate to CO₂ and H₂O EXCEPT:
   a) pantothenate
   b) niacin
   c) thiamine
   d) biotin
   e) riboflavin

22. Compound A: HOOC-CH(OH)-CH(COOH)-CH₂-COOH;
    Compound B: HOOC-CH=CH-COOH
    The segment of the TCA cycle in which Compound A is converted to Compound B:
   a) yields 5 moles of high-energy phosphate bonds per mole of A
   b) requires a coenzyme synthesized in the human from niacin (nicotinamide)
   c) is catalyzed by enzymes located solely in the mitochondrial membrane
   d) produces 1 mole of CO₂ for every mole of Compound A oxidized
   e) requires GTP to drive one of the reactions

23. The reactions of the TCA cycle oxidizing succinate to oxaloacetate:
   a) require coenzyme A
   b) include an isomerization reaction
   c) produce one high-energy phosphate bond
d) require both NAD$^+$ and FAD  
e) produce one GTP from GDP + P$_i$

24. Each of the following statements concerning pyruvate dehydrogenase is true EXCEPT:
   a) it is an example of a multienzyme complex  
   b) it requires thiamine pyrophosphate as a cofactor  
   c) it produces oxaloacetate from pyruvate  
   d) it is converted to an inactive form by phosphorylation  
   e) it is inhibited when NADH levels increase

25. The principal function of the TCA cycle is to:
   a) generate CO$_2$  
   b) transfer electrons from the acetyl portion of acetyl CoA to NAD$^+$ and FAD  
   c) oxidize the acetyl portion of acetyl CoA to oxaloacetate  
   d) generate heat from the oxidation of the acetyl portion of acetyl CoA  
   e) dispose of excess pyruvate and fatty acids

26. During exercise, stimulation of the TCA cycle results principally from:
   a) allosteric activation of isocitrate dehydrogenase by increased NADH  
   b) allosteric activation of fumarase by increased ADP  
   c) a rapid decrease in the concentration of four-carbon intermediates  
   d) product inhibition of citrate synthase  
   e) stimulation of the flux through a number of enzymes by a decreased NADH/NAD$^+$ ratio

27. A man presents to the emergency department after ingesting an insecticide. His respiration rate is very low. Information from the Poison Control Center indicates that this particular insecticide binds to and completely inhibits cytochrome c. Therefore, in this man's mitochondria:
   a) coenzyme Q would be in the oxidized state  
   b) cytochromes a and a3 would be in the reduced state  
   c) the rate of ATP synthesis would be approximately zero  
   d) the rate of CO$_2$ production would be increased

28. Which one of the following statements best describes the consequence of ingesting a compound that stimulates ATP hydrolysis by plasma membrane Na+/K+ -ATPase?
   a) The pH gradient across the mitochondrial membranes would increase  
   b) The rate of conversion of NADH to NAD$^+$ in the mitochondria would decrease  
   c) Heat production would decrease  
   d) The transfer of electrons to O$_2$ would increase

29. This vitamin is required for NAD$^+$ synthesis.
   a) Riboflavin  
   b) Pantothenic acid  
   c) Niacin  
   d) Vitamin B$_6$

30. This vitamin is required for FAD synthesis.
   a) Riboflavin  
   b) Pantothenic acid  
   c) Niacin
31. This vitamin is required for Coenzyme A synthesis.
   a) Riboflavin
   b) Pantothenic acid
   c) Niacin
   d) Vitamin B₆

32. This vitamin is required for FMN synthesis.
   a) Riboflavin
   b) Pantothenic acid
   c) Niacin
   d) Vitamin B₆

33. This vitamin is required for pyridoxal phosphate synthesis.
   a) Riboflavin
   b) Pantothenic acid
   c) Niacin
   d) Vitamin B₆

34. The appropriate vitamin for blood clotting is:
   a) Vitamin A
   b) Vitamin C
   c) Vitamin D
   d) Vitamin K

35. The appropriate vitamin for calcium metabolism is:
   a) Vitamin A
   b) Vitamin C
   c) Vitamin D
   d) Vitamin K

36. The appropriate vitamin for collagen synthesis is:
   a) Vitamin A
   b) Vitamin C
   c) Vitamin D
   d) Vitamin K

37. The appropriate vitamin for vision is:
   a) Vitamin A
   b) Vitamin C
   c) Vitamin D
   d) Vitamin K

38. An intermediate in the conversion of citrate to succinyl CoA in the TCA cycle:
   a) malate
   b) α-ketoglutarate
   c) citrate
   d) succinate
39. Converted to isocitrate by the enzyme aconitase:
   a) malate
   b) α-ketoglutarate
   c) citrate
   d) succinate

40. Formed by the addition of water across the double bond of fumarate:
   a) malate
   b) α-ketoglutarate
   c) citrate
   d) succinate

41. Oxidized to oxaloacetate by proper dehydrogenase:
   a) malate
   b) α-ketoglutarate
   c) citrate
   d) succinate

42. Generated in a reaction that produces GTP:
   a) malate
   b) α-ketoglutarate
   c) citrate
   d) succinate

43. The vitamin or vitamins required for activity of pyruvate dehydrogenase complex:
   a) Thiamine
   b) Niacin
   c) Thiamine and niacin
   d) Neither thiamine nor niacin

44. The vitamin or vitamins required for activity of malate dehydrogenase:
   a) Thiamine
   b) Niacin
   c) Thiamine and niacin
   d) Neither thiamine nor niacin

45. The vitamin or vitamins required for activity of pyruvate carboxylase:
   a) Thiamine
   b) Niacin
   c) Thiamine and niacin
   d) Neither thiamine nor niacin

46. The vitamin or vitamins required for activity of α-ketoglutarate dehydrogenase complex:
   a) Thiamine
   b) Niacin
   c) Thiamine and niacin
   d) Neither thiamine nor niacin
47. The vitamin or vitamins required for activity of succinate dehydrogenase:
   a) Thiamine  
   b) Niacin  
   c) Thiamine and niacin  
   d) Neither thiamine nor niacin

48. Regulated allosterically by ADP:
   a) Isocitrate dehydrogenase  
   b) Malate dehydrogenase  
   c) Both isocitrate and malate dehydrogenase  
   d) Neither dehydrogenase

49. Liberates CO\textsubscript{2}:
   a) Isocitrate dehydrogenase  
   b) Malate dehydrogenase  
   c) Both isocitrate and malate dehydrogenase  
   d) Neither dehydrogenase

50. Reduces a cofactor that transfers electrons to the electron transport chain:
   a) Isocitrate dehydrogenase  
   b) Malate dehydrogenase  
   c) Both isocitrate and malate dehydrogenase  
   d) Neither dehydrogenase

51. Utilizes FAD as a cofactor:
   a) Isocitrate dehydrogenase  
   b) Malate dehydrogenase  
   c) Both isocitrate and malate dehydrogenase  
   d) Neither dehydrogenase

52. Which electron-transporting chain components transports only electrons?
   a) cytochrome b  
   b) NAD  
   c) FMN  
   d) ubiquinone

53. Which substance contains high-energy phosphate?
   a) adenosinemonophosphate  
   b) creatinephosphate  
   c) FAD  
   d) NADP

54. Fe\textsuperscript{2+} and Cu\textsuperscript{+} atoms are in the active center of...
   a) cytochrome c  
   b) NADH-dehydrogenase  
   c) ubiquinol dehydrogenase  
   d) succinate dehydrogenase  
   e) cytochromeoxydase
55. Able to transport both electrons and protons:
   a) ubiquinone
   b) cytochromeoxydase
   c) cytochrome c
   d) cytochrome b

56. In respiratory chain between ubiquinon and cytochrome c1 there is a:
   a) cytochrome c
   b) cytochrome b5
   c) cytochrome b
   d) cytochrome a

57. Reducing of FAD(FMN) is characterized with proton bonding to:
   a) carbon atoms
   b) nitrogen atoms
   c) oxygen atoms
   d) phosphorus atoms

58. Ubiquinone diffuses easy in mitochondrial membrane because it is:
   a) big lipophilic molecule
   b) big hydrophilic molecule
   c) little lipophilic molecule
   d) little hydrophilic molecule

59. Terminal oxygen acceptor in ETC there is:
   a) hydrogen
   b) ubiquinone
   c) NAD
   d) oxygen
   e) cytochromoxidase

60. Electron donor in ETC there is:
   a) hydrogen
   b) oxygen
   c) sulfur
   d) iron
   e) copper

61. Oxidative decarboxyilation of pyruvate yields:
   a) citrate
   b) acetyl-CoA
   c) succinyl-CoA
   d) lactate

62. Macroergic substrate is:
   a) acetyl-CoA
b) citrate
c) succinate
d) lactate

63. Compound which is not TCA metabolite:
   a) acetyl-CoA
   b) citrate
   c) succinyl-CoA
   d) lactate

64. The product of α-ketoglutarate dehydrogenase complex:
   a) acetyl-CoA
   b) citrate
   c) succinyl-CoA
   d) lactate

65. Hydration reaction in TCA:
   a) fumarate → malate
   b) citrate → cis-aconitate
   c) malate → oxaloacetate
   d) isocitrate → α-ketoglutarate

66. Dehydrogenase reaction in TCA:
   a) fumarate → malate
   b) cis-aconitate → isocitrate
   c) citrate → cis-aconitate
   d) isocitrate → α-ketoglutarate

67. Lyase reaction in TCA:
   a) cis-aconitate → isocitrate
   b) malate → oxaloacetate
   c) isocitrate → α-ketoglutarate

68. Substrate level phosphorylation reaction in TCA:
   a) fumarate → malate
   b) cis-aconitate → isocitrate
   c) succinyl-Coa → succinate
   d) α-ketoglutarate → succinyl-CoA
   e) malate → oxaloacetate
   f) isocitrate → α-ketoglutarate

69. Localized in the intermembrane space of mitochondria
   a) cytochrome a
   b) cytochrome a3
   c) cytochrome b
   d) cytochrome c1
   e) cytochrome c
   f) ubiquinone
70. Makes cytochrome oxidase
   a) cytochrome a3
   b) cytochrome b
   c) cytochrome c1
   d) cytochrome c
   e) ubiquinone

71. Water soluble
   a) cytochrome a
   b) cytochrome a3
   c) cytochrome b
   d) cytochrome c1
   e) cytochrome c
   f) ubiquinone

72. Do not form any ETC complex
   a) cytochrome a
   b) cytochrome a3
   c) cytochrome b
   d) cytochrome c1
   e) cytochrome c

73. Amylase activity in urine is increased in
   a) hepatitis
   b) pancreatitis
   c) kidney problems
   d) heart attack
   e) tuberculosis

74. Amylase activity in urine is decreased in
   a) hepatitis
   b) pancreatitis
   c) parotitis
   d) kidney problems
   e) heart attack
   f) tuberculosis

75. Catalase activity in blood is decreased in
   a) hepatitis
   b) pancreatitis
   c) parotitis
   d) kidney problems
   e) heart attack
   f) tuberculosis

76. Uncouples oxidative phosphorylation
   a) Amobarbital
b) Carboxin
c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

77. P/O for NADH
   a) 0
   b) 1
   c) 2
   d) 3
   e) 4

78. P/O for FADH$_2$
   a) 0
   b) 1
   c) 2
   d) 3
   e) 4

79. P/O for ascorbate
   a) 0
   b) 1
   c) 2
   d) 3
   e) 4

80. P/O for H$_2$O
   a) 0
   b) 1
   c) 2
   d) 3
   e) 4

81. Blocks ETC complex I
   a) Amobarbital
   b) Carboxin
   c) Antimycin
   d) Cyanide
   e) Dinitrophenol
   f) Oligomycin
   g) Atractiloside

82. Blocks ETC complex II
   a) Amobarbital
   b) Carboxin
   c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

83. Inhibits ETC complex III
   a) Amobarbital
   b) Carboxin
c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

84. Blocks ETC complex IV
   a) Amobarbital
   b) Carboxin
c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

85. Inhibits H⁺-ATP-ase
   a) Amobarbital
   b) Carboxin
c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

86. Inhibits ATP/ADP-antiporter
   a) Amobarbital
   b) Carboxin
c) Antimycin
d) Cyanide
e) Dinitrophenol
f) Oligomycin
g) Atractiloside

87. Uses oxygen as hydrogen acceptor
   a) oxydase
   b) dehydrogenase
c) hydroperoxydase
d) monoxygenase
e) dioxygenase
f) catalase
88. Transfers $H_2$ from one substrate to another in redox-reactions
   a) oxydase
   b) dehydrogenase
   c) hydroperoxydase
   d) monooxygenase
   e) dioxygenase
   f) catalase

89. Uses hydrogen peroxide or an organic peroxide as substrate
   a) oxydase
   b) dehydrogenase
   c) hydroperoxydase
   d) monooxygenase
   e) dioxygenase

90. Catalyses the direct transfer and incorporation of oxygen into a substrate
   a) oxydase
   b) dehydrogenase
   c) hydroperoxydase
   d) monooxygenase
   e) catalase

91. Its activity in RBC is low in cancer and tuberculosis
   a) oxydase
   b) dehydrogenase
   c) hydroperoxydase
   d) monooxygenase
   e) dioxygenase
   f) catalase

PART 3. TEST "BIOCHEMISTRY OF CARBOHYDRATES"

92. Chondroitine sulfates are built of:
   a) disaccharide including glucose and fructose
   b) disaccharide, including uronic acid and acetylhexosamine
   c) hexosamine
   d) fructose

93. The hyaluronic acid consists of:
   a) glucuronic acid and N-acetylglucosamine
   b) glucose and a fructose
   c) glucuronic acid and N-acetylglactosamine-6-sulfate

94. Glucosamine proteoglycans contain as a prosthetic part
   a) fucose
   b) aminosugars
   c) sialic acid
   d) neuraminic acid
   e) mucopolysaccharides
95. What carbohydrate cannot be digested, but should be present in the diet?
   a) starch  
   b) cellulose  
   c) lactose  
   d) maltose

96. Dietary pectins are necessary for:
   a) building of cell walls  
   b) energy sources  
   c) prevent absorption of nutrients  
   d) binding of heavy metals, toxins etc.

97. Choose the high-energy phosphates containing substance:
   a) 1,3-diphosphoglycerate  
   b) 3-phosphoglycerate  
   c) pyruvate  
   d) adenosine monophosphate

98. What stage of energy substrates formation scheme has the greatest ATP output?
   a) 1st  
   b) 2nd  
   c) 3rd  
   d) all three

99. Oxidative decarboxylation of pyruvate produces:
   a) acetyl CoA  
   b) citrate  
   c) succinyl-CoA  
   d) lactate

100. The hydration of substrates in TCA occurs in the reactions:
   a) fumarate ---> malate  
   b) citrate ---> cis-aconitate  
   c) malate ---> oxaloacetate  
   d) isocitrate ---> α-ketoglutarate

101. How NAD⁺/NADH+H⁺ and ADP/ATP ratios in heart change during dream in comparison 
     with an awake condition?
   a) the first decreases, the second increases  
   b) the first increases, the second decreases  
   c) both decrease  
   d) both increase

102. The multienzyme pyruvate dehydrogenase complex encounters:
   a) 5 enzymes and 5 coenzymes  
   b) 3 enzymes and 5 coenzymes
c) 5 enzymes and 3 coenzymes

103. Enzyme of substrate phosphorylation in TCA
   a) isocitrate dehydrogenase
   b) succinyl-CoA-synthetase
   c) succinate dehydrogenase

104. What substances entering with nutrition are the precursors of pyruvate?
   a) carbohydrates
   b) fatty acids
   c) cholesterol
   d) cellulose

105. Function of pyruvate dehydrogenase complex is
   a) synthesis of pyruvate
   b) synthesis of lactate
   c) formation of acetyl-CoA for the further oxidation
   d) formation of oxaloacetate for TCA

106. TCA is oxygen dependent process, because oxygen...
   a) activates citrate synthase
   b) is necessary for the regeneration of NAD$^+$ and FAD
   c) is necessary for the synthesis of oxaloacetate
   d) is necessary for the regeneration of acetyl-CoA

107. Oxidation reaction is:
   a) oxaloacetate ---\rightarrow citrate
   b) citrate ---\rightarrow isocitrate
   c) malate ---\rightarrow oxaloacetate
   d) fumarate ---\rightarrow malate

108. The velocity of TCA reactions is decreased during the rest due to accumulation of...
   a) ATP
   b) lactate
   c) pyruvate
   d) FADH$_2$

109. This conversions occurs at the 2nd stage of energy substrates formation:
   a) proteins ---\rightarrow amino acids
   b) acetyl-CoA ---\rightarrow H$_2$O + CO$_2$
   c) fat ---\rightarrow glycerol + fatty acids
   d) aminoacids ---\rightarrow pyruvate

110. In what reactions of TCA decarboxylation occurs?
   a) oxaloacetate ---\rightarrow citrate
   b) α-ketoglutarate ---\rightarrow succinyl-CoA
   c) fumarate---\rightarrow malate
d) malate ---> oxaloacetate

111. How many molecules of NADH+H+ can be formed per one TCA turn?
   a) 1
   b) 2
   c) 3
   d) 4

112. Choose correct sequence of participation of coenzymes in oxidative decarboxylation of pyruvate:
   a) HSCoA, TPP, NAD, FAD, lipoamide
   b) TPP, HSCoA, lipoamide, FAD, NAD
   c) TPP, lipoamide, HSCoA, FAD, NAD
   d) NAD, TPP, HSCoA, lipoamide, FAD

113. At the third stage of unification of energy substrates there is a transformation:
   a) polysaccharides ---> monosaccharides
   b) acetyl-CoA ---> H2O +CO2
   c) fatty acids ---> ketone bodies
   d) glycerol ---> pyruvate

114. The transformation of succinate to malate in TCA reactions occurs through:
   a) citrate
   b) fumarate
   c) oxaloacetate
   d) succinyl-CoA

115. How many molecules FADH2 are formed during TCA?
   a) 1
   b) 2
   c) 3
   d) 0

116. During reactions of unification of energy substrates one common metabolite is formed:
   a) pyruvate
   b) citrate
   c) acetyl-CoA
   d) succinyl-CoA

117. Choose the metabolites of tricarboxylic acid cycle
   a) pyruvate, lactate
   b) glucose, glycerol
   c) aspartate, glutamate
   d) oxaloacetate, succinate

118. What reactions in TCA are catalyzed by NAD-dependent enzymes?
   a) isocitrate \(\rightarrow\) \(\alpha\)-ketoglutarate
b) succinate $\rightarrow$ fumarate
\[ \text{M} \text{P} \text{O} \text{D} \text{O} \text{X} \text{A} \text{O} \text{A} \text{C} \text{E} \text{T} \text{E} \rightarrow \text{CITRAT} \text{E} \]

119. How many ATP is formed at oxidation of one molecule of acetyl-CoA?

- a) 3
- b) 6
- c) 9
- d) 12
- e) 15

120. Complete oxidation of pyruvate molecule yields:

- a) 9 ATP
- b) 15 ATP
- c) 12 ATP
- d) 3 ATP
- e) 18 ATP

121. The first stage in the oxidation of pyruvate to acetyl-CoA is the reaction of:

- a) decarboxylation
- b) dehydrogenation
- c) transfer of acetyl group

122. The coenzyme form of vitamin B$_1$ is:

- a) pyridoxal phosphate
- b) flavineadeninonucleotide
- c) nicotinamide nucleotide
- d) thiaminepyrophosphate
- e) retinal

123. The coenzyme form of vitamin H is:

- a) pyridoxal phosphate
- b) methylcobalamine
- c) retinal
- d) thiaminepyrophosphate
- e) N-biotinyllysine

124. Biochemical function of vitamin C:

- a) vision
- b) transport of acyl groups
- c) hydroxylation of proline residues
- d) transport of CO$_2$

125. Biochemical functions of TPP (thiamine pyrophosphate)

- a) hydrogen transfer
- b) transamination and decarboxylation of amino acids
- c) decarboxylation of $\alpha$-keto acids
- d) transport of acyl groups
126. Enzymes are classified according to the:
   a) structure
   b) substrate specificity
   c) activity
   d) type of catalyzed reaction
   e) organ belonging

127. The molecule of LDH consists of subunits type:
   a) M and B
   b) H and M
   c) M, B and H
   d) B and H
   e) only B

128. Cardiomyocytes in the greatest amount contain isoenzyme:
   a) LDH-1
   b) LDH-2
   c) LDH-3
   d) LDH-4
   e) LDH-5

129. Hepatocytes mainly contain isoenzyme:
   a) LDH-1
   b) LDH-2
   c) LDH-3
   d) LDH-4
   e) LDH-5

130. The most informative for diagnosis of an acute pancreatitis is the determination of the activity of:
   a) LDH-1
   b) LDH-5
   c) AST
   d) ALT
   e) α-amylase

131. The activity of LDH changes at increase of temperature from 30 up to 40 centigrades will:
   a) doesn't change
   b) become peer to zero
   c) increase 2-4 times
   d) decrease 2-4 times
   e) increase 10 times

132. This vitamin is the part of some oxidoreductase:
   a) B₁
   b) B₁₂
   c) C
   d) PP
133. What reactions catalyze enzymes which structure includes the derivative of vitamin PP?
   a) decarboxylation
   b) hydrogen transfer
   c) transfer of amino groups
   d) transfer of carboxyl groups
   e) transfer of methyl groups

134. To what class belongs the enzyme catalyzing the reaction:
   \[ \text{CH}_3\text{-CH(NH}_2\text{-COOH} + \text{HOOC-CH}_2\text{-CH}_2\text{-CO-COOH} \rightarrow \text{CH}_3\text{-CO-COOH} + \text{HOOC-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{-COOH} \]
   a) oxidoreductases
   b) transferases
   c) hydrolases
   d) lyases
   e) ligases
   f) isomerases

135. What role play the disulfide bonds in enzyme molecule:
   a) stabilize the secondary structure
   b) stabilize the tertiary structure
   c) stabilize the quaternary structure
   d) substrate binding

136. In what part of enzyme the metals are more often?
   a) prosthetic group
   b) substrate-binding site
   c) allosteric centre
   d) catalytic site

137. To which class belongs the enzyme catalyzing the reaction:
   \[ \text{HOOC-CHOH-CH}_2\text{-COOH} \rightarrow \text{HOOC-CH}=\text{CH-COOH} + \text{H}_2\text{O} \]
   a) oxidoreductases
   b) hydrolases
   c) lyases
   d) ligases
   e) transferases
   f) isomerases

138. To which class belongs the enzyme catalyzing the reaction:
   \[ \text{HOOC-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{-COOH} \rightarrow \text{HOOC-CH}_2\text{-CH}_2\text{-CH}_2\text{-NH}_2 + \text{CO}_2 \]
   a) oxidoreductases
   b) hydrolases
   c) lyases
   d) ligases
   e) transferases
139. Which enzyme catalyzes the reaction:
   \[ \text{CH}_3\text{-CO-COOH} + \text{NADH} \rightarrow \text{CH}_3\text{-CHOH-COOH} + \text{NAD}^+ \]
   a) lactate dehydrogenase
   b) pyruvate dehydrogenase
   c) succinate dehydrogenase
   d) malate dehydrogenase

140. Which enzyme catalyzes the reaction:
   \[ \text{CH}_3\text{-CHOH-COOH} + \text{NAD}^+ \rightarrow \text{CH}_3\text{-CO-COOH} + \text{NADH} \]
   a) lactate dehydrogenase
   b) pyruvate dehydrogenase
   c) succinate dehydrogenase
   d) malate dehydrogenase

141. Which is the competitive inhibitor of succinate dehydrogenase?
   a) COOH-CH$_2$-COOH
   b) COOH-CH$_2$-CH$_2$-COOH
   c) COOH-CO-CH$_3$
   d) COOH-CH$_2$-COH
   e) COOH-CH$_2$-CH$_3$

142. In sugar diabetes the high density urine is secreted since the glucose has very high osmotic activity.
   a) the first part of the statement is true, the second - is true, there is a causal nexus
   b) the first part of the statement is true, the second - is incorrect, there is no causal nexus
   c) the first part of the statement is true, the second - is true, there is no causal nexus
   d) the first part of the statement is incorrect, the second - is true, there is no causal nexus
   e) the first part of the statement is incorrect, the second - is incorrect, there is no causal nexus

143. What substances are determined in the urine in sugar diabetes?
   a) protein
   b) glucose
   c) urobilin
   d) creatine
   e) haemoglobin
   f) bilirubin

144. What substances are determined in the urine in starving state?
   a) protein
   b) haemoglobin
   c) bilirubin
   d) glucose
   e) ketone bodies
   f) creatine

145. What enzyme is crucial for breaking of salvaging of glucose in sugar diabetes?
   a) hexokinase
   b) aldolase
   c) phosphofructokinase
   d) phosphorylase
146. Through which metabolite the pyruvate will be converted to glucose?
   a) COOH-CO-CH2-COOH
   b) COOH-CHOH-CH2-COOH
   c) COOH-CHOH-CH3
   d) CH3-CO-S-CoA
   e) CH3-CO-CH3

147. What TCA metabolite oxidation is impaired at the drop of NAD\(^{+}\)/NADH ratio in sugar diabetes?
   a) COOH-CO-CH2-COOH
   b) COOH-CHOH-CH3
   c) CH3-CO-S-KoA
   d) CH3-CO-CH3
   e) COOH-CHOH-CH2-COOH
   f) COOH-CH2-CH2-COOH

148. What is the mechanism of intracellular regulation of metabolism?
   a) regulation by hormones
   b) regulation of enzymes activity by releasing factors
   c) isosteric regulation
   d) allosteric regulation

149. Key metabolite, which is poor utilized in TCA in sugar diabetes due to low activity of citrate synthase
   a) CH3-CO-S-CoA
   b) COOH-CO-CH2-COOH
   c) COOH-CHOH-CH2-COOH
   d) COOH-CHOH-CH3
   e) CH3-CO-CH3
   f) COOH-CH2-CH2-COOH
   g) COOH-CH2-CH2-CO-S-CoA

150. The insulin decreases glucose blood level BECAUSE it increases permeability of cell membranes in the brain for glucose
   a) the first part of the statement is true, the second - is true, there is a causal nexus
   b) the first part of the statement is true, the second - is true, there is no causal nexus
   c) the first part of the statement is true, the second - is incorrect, there is no causal nexus
   d) the first part of the statement is incorrect, the second - is incorrect, there is no causal nexus
   e) the first part of the statement is incorrect, the second - is true, there is no causal nexus

151. The activity of which enzyme is impaired in low NAD\(^{+}\)/NADH ratio?
   a) citrate synthase
   b) isocitrate dehydrogenase
   c) succinate dehydrogenase
   d) aldolase
   e) hexokinase
   f) glucose-6-phosphate dehydrogenase

152. How the activity of glucose-6-phosphate dehydrogenase will be changed in increased NADP/NADPH\(_2\) ratio:
   a) will be increased
   b) will be decreased
c) will not be changed

153. The enzyme which is stimulated by insulin:
   a) PEP-carboxykinase
   b) glucose-6-phosphatase
   c) fructose-1,6-bisphosphatase
   d) citrate synthase
   e) glycogen phosphorylase
   f) lipase

154. Vitamin PP deficiency can result in drop of enzyme activity:
   a) citrate synthase
   b) PEP-carboxykinase
   c) glucose-6-phosphatase
   d) fructose-1,6-bisphosphatase
   e) malate dehydrogenase
   f) glycogen phosphorylase

155. Increased glucagon level promotes development of sugar diabetes BECAUSE the glucagon is developed in the delta-cells of islets of Langerhans.
   a) the first part of the statement is incorrect, the second is true, there is no causal nexus
   b) the first part of the statement is true, the second is true, there is a causal nexus
   c) the first part of the statement is incorrect, the second is incorrect, there is no causal nexus
   d) the first part of the statement is true, the second is incorrect, there is no causal nexus

156. Pentose phosphate pathway blocking in sugar diabetes results in:
   a) drop of NADPH
   b) decrease of glucose-6-phosphate
   c) increase of acetyl-CoA
   d) predominance of ketone bodies synthesis
   e) inhibition of citrate synthase
   f) inhibition of hexokinase

157. The conversion of 3-phosphoglycerate to the fatty acids is carried out through
   a) acetoacetate
   b) β-hydroxybutyrate
   c) aspartate
   d) acetyl-CoA
   e) glycerol phosphate
   f) oxaloacetate

158. The activity of blood α-amylase is increased in liver diseases BECAUSE the liver plays an important role in carbohydrate metabolism.
   a) the first part of the statement is incorrect, the second is true, there is no causal nexus
   b) the first part of the statement is true, the second is true, there is a causal nexus
   c) the first part of the statement is true, the second is incorrect, there is no causal nexus
   d) the first part of the statement is true, the second is true, there is no causal nexus
   e) the first part of the statement is incorrect, the second is incorrect, there is no causal nexus

159. Liver is the unique organ delivering glucose for all organism needs BECAUSE it contains the greatest quantity of glycogen as compared with other organs and tissues.
   a) the first part of the statement is true, the second is incorrect, there is no causal nexus
   b) the first part of the statement is true, the second is true, there is no causal nexus
   c) the first part of the statement is incorrect, the second is true, there is no causal nexus
   d) the first part of the statement is true, the second is true, there is a causal nexus
the first part of the statement is incorrect, the second - is incorrect, there is no causal nexus

160. Somatotropin is a hormone:
   a) anabolic
   b) catabolic
   c) antidiabetogenic
   d) lipogenic

161. The adrenalin is a hormone
   a) anabolic
   b) catabolic
   c) antidiabetogenic
   d) lipogenic

162. Which enzyme activates specific phosphorylase kinase?
   a) adenylate cyclase
   b) guanylate cyclase
   c) protein kinase
   d) phosphodiesterase

163. Which enzyme catalyzes the formation of cAMP?
   a) adenylate cyclase
   b) guanylate cyclase
   c) protein kinase
   d) phosphorylase kinase
   e) phosphorylase

164. The concentration of cAMP in the cell is monitored by the enzyme:
   a) guanylate cyclase
   b) protein kinase
   c) phosphorylase kinase
   d) phosphodiesterase
   e) phosphorylase

165. Which hormone activates the synthesis of proteins, lipids and carbohydrates?
   a) insulin
   b) prolactin
   c) somatotropin
   d) lutein stimulating hormone
   e) thymosine

166. Which hormone represents the 51 amino acid containing protein and consisting of 2 polypeptide chains?
   a) insulin
   b) glucagon
   c) adrenoglomerulotropin
   d) oxytocinum
   e) aldosteronum

167. How the metabolism will be changed after drinking of tea, coffee, cocoa (the caffeine in these beverages is an inhibitor of phosphodiesterase)?
   a) decreasing of cAMP level
   b) cAMP accumulation
   c) decreasing of metabolism rate
   d) no changes
168. What substance is necessary in the reaction: Citrate + HSCoA $\rightleftharpoons$ Oxaloacetate + ...
   a) acetyl-CoA  
   b) β-ketoacyl-CoA  
   c) malonyl-CoA  
   d) acyl-CoA  
   e) butyryl-CoA  
   f) enoyl-CoA  
   g) succinyl-CoA

169. Choose the INCORRECT statement:
   a) ribose is monosaccharide  
   b) lactose is monosaccharide  
   c) the saccharose consists of fructose and glucose  
   d) starch contains α-1,4-glycoside bonds  
   e) starch contains α-1,6-glycoside bonds

170. Choose the correct statements:
   a) glucose is aldose  
   b) desoxyribose is a polysaccharide  
   c) cellulose consists of the glucose residues linked by α-glycosidic bonds  
   d) heparin is a homopolysaccharide

171. Which from the listed nucleotides is the carrier of glucose residues in the biosynthesis of glycogen?
   a) NAD  
   b) FAD  
   c) UTP  
   d) UDP  
   e) ADP  
   f) GTP

172. Which enzyme catalyzes the reaction:
   $$(C_6H_{10}O_5)_n + P_1 \rightarrow (C_6H_{10}O_5)_{n-1} + \text{glucose-1-phosphate}$$
   a) amylase  
   b) hexokinase  
   c) phosphorylase  
   d) phosphoglucomutase  
   e) glucose-6-phosphatase  
   f) glycogen synthase

173. Which enzyme catalyzes the reaction:
   glucose-6-phosphate $\leftrightarrow$ glucose-1-phosphate
   a) phosphohexose isomerase  
   b) glucose-6-phosphatase  
   c) hexokinase  
   d) aldolase  
   e) phosphoglucomutase

174. Choose the true continuation: "In the muscles glucose-6-phosphate isn't converted to glucose because there is no enzyme... 
   a) glucose-6-phosphatase  
   a) glucokinase  
   b) hexokinase
c) aldolase
d) phosphoglucomutase

175. Which enzyme catalyzes the reaction:
\[ \text{glucose-6-phosphate } \leftrightarrow \text{fructose-6-phosphate} \]
a) phosphoglucomutase
b) phosphofructokinase
c) phosphorylase
d) phosphatase
b) phosphohexose isomerase

176. Which enzyme catalyzes the reaction:
\[ \text{fructose-6-phosphate } \rightarrow \text{glucose-6-phosphate} \]
a) phosphoglucomutase
b) phosphohexose isomerase
c) phosphofructokinase
d) fructose-1,6-bisphosphatase
e) glucose-6-phosphatase

177. Specify the enzyme which failure produces galactosemia:
a) galactokinase
b) UDP-galactose epimerase
c) galactose-1-phosphate-uridylyl transferase
d) galactose-1-phosphatase

178. Which reaction is catalyzed by glycogen synthase?
a) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-2} + \text{maltose}\)
b) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_3\text{P}O_4 \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose-1-phosphate}\)
c) \((\text{C}_6\text{H}_{10}\text{O}_5)_{n+1} + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose}\)
d) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow \text{dextrins } \rightarrow \text{maltose}\)
e) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{UDP-glucose } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n+1} + \text{UDP}\)
f) \(\text{C}_6\text{H}_{12}\text{O}_6 + \text{ATP } \rightarrow C_6\text{H}_{11}\text{O}_6\text{PO}_3\text{H}_2 + \text{ADP}\)

179. Which reaction is catalyzed by hexokinase (glucokinase)
a) \((\text{C}_6\text{H}_{10}\text{O}_5)_{n+1} + \text{UDP-glucose } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n+1} + \text{UDP}\)
b) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose}\)
c) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-2} + \text{maltose}\)
d) \(\text{C}_6\text{H}_{12}\text{O}_6 + \text{ATP } \rightarrow C_6\text{H}_{11}\text{O}_6\text{PO}_3\text{H}_2 + \text{ADP}\)
e) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow \text{dextrins } \rightarrow \text{maltose}\)
f) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_3\text{PO}_4 \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose-1-phosphate}\)

180. Which reaction is catalyzed by α-amylase?
a) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose}\)
b) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-2} + \text{maltose}\)
c) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_2\text{O } \rightarrow \text{dextrins } \rightarrow \text{maltose}\)
d) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{UDP-glucose } \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n+1} + \text{UDP}\)
e) \((\text{C}_6\text{H}_{10}\text{O}_5)_n + \text{H}_3\text{PO}_4 \rightarrow (\text{C}_6\text{H}_{10}\text{O}_5)_{n-1} + \text{glucose-1-phosphate}\)
f) \(\text{C}_6\text{H}_{12}\text{O}_6 + \text{ATP } \rightarrow C_6\text{H}_{11}\text{O}_6\text{PO}_3\text{H}_2 + \text{ADP}\)
181. What reaction is catalyzed by glycogen phosphorylase?
   a) \((C6H10O5)n + H2O \rightarrow (C6H10O5)n-1 + \text{glucose}\)
   b) \((C6H10O5)n + H2O \rightarrow (C6H10O5)n-2 + \text{maltose}\)
   c) \((C6H10O5)n + H2O \rightarrow \text{dextrins} \rightarrow \text{maltose}\)
   d) \((C6H10O5)n + \text{UDP-glucose} \rightarrow (C6H10O5)n+1 + \text{UDP}\)
   e) \((C6H10O5)n + \text{H3PO4} \rightarrow (C6H10O5)n-1 + \text{glucose-1-phosphate}\)

182. The glycogen is:
   a) the unbranched polysaccharide consisting of glucose residues, linked by \(\alpha-1,4\)- and \(\alpha-1,6\)-glycosidic bond
   b) the linear polysaccharide consisting of glucose residues, linked by \(\alpha-1,4\)-glycosidic bond
   c) heavy-branched polysaccharide consisting of glucose residues, linked by \(\alpha-1,4\)- and \(\alpha-1,6\)-glycosidic bond
   d) the linear polysaccharide consisting of glucose residues, linked by \(\beta-1,4\)-glycosidic bond

183. Deficiency of which enzyme results in von Gierke disease?
   a) phosphorylase
   b) glucose-6-phosphatase
   c) amylo-1,6-glucosidase
   d) galactose-1-phosphate-uridyltransferase
   e) acidic \(\alpha\)-glucosidase

184. Deficiency of which enzyme results in aglycogenosis?
   a) glycogen synthase
   b) glucose-6-phosphatase
   c) muscular phosphorylase
   d) amylo-1,6-glucosidase
   e) galactose-1-phosphate-uridyltransferase
   f) acidic \(\alpha\)-glucosidase

185. Cori’s (Forbs’) disease - deficiency of the enzyme:
   a) glucose-6-phosphatase
   b) muscular phosphorylase
   c) glycogensynthase
   d) amylo-1,6-glucosidase
   e) galactose-1-phosphate-uridyltransferase
   f) acidic \(\alpha\)-glucosidase

186. McArdle disease - deficiency of the enzyme:
   a) glycogensynthase
   b) glucose-6-phosphatase
   c) amylo-1,6-glucosidase
   d) galactose-1-phosphate-uridyltransferase
   e) phosphorylase in muscles
   f) acidic \(\alpha\)-glucosidase
187. Which hormones cause hypoglycemia?
   a) insulin
   b) cortisol
   c) thyroxin
   d) glucagon
   e) growth hormone
   f) testosterone

188. How many ATP is formed after complete oxidation of 1 fructose-1,6-bisphosphate molecule?
   a) 15
   b) 24
   c) 37
   d) 36
   e) 38

189. Which reaction is catalyzed by phosphofructokinase?
   a) phosphoenolpyruvate + ADP ---> pyruvate + ATP
   b) fructose-6-phosphate + ATP ---> fructose-1,6-bisphosphate + ADP
   c) fructose-1,6-bisphosphate ---> 3-phosphoglyceraldehyde + DHAP
   d) pyruvate ---> lactate
   e) 2-phosphoglycerate ---> 3-phosphoglycerate

190. Specify the non-reversible reaction of glycolysis:
   a) phosphoenolpyruvate + ADP ---> pyruvate + ATP
   b) fructose-1,6-bisphosphate ---> 3-phosphoglyceraldehyde + DHAP
   c) pyruvate ---> lactate
   d) 3-phosphoglycerate ---> 2-phosphoglycerate

191. Specify the reversible reaction of glycolysis:
   a) glucose + ATP ---> glucose-6-phosphate + ADP
   b) fructose-6-phosphate + ATP ---> fructose-1,6-bisphosphate + ADP
   c) fructose-1,6-bisphosphate ---> 3-phosphoglyceraldehyde + DHAP
   d) phosphoenolpyruvate + ADP ---> pyruvate + ATP

192. Which reaction is catalyzed by transketolase?
   a) glucose-6-phosphate + NADP ---> 6-phosphogluconate + HADPH2
   b) 6-phosphogluconate + NADP ---> ribulose-5-phosphate + HADPH2 + CO2
   c) fructose + ATP ---> fructose-1-phosphate + ADP
   d) xylulose-5-phosphate + ribose-5-phosphate ---> 3-phosphoglyceraldehyde + sedoheptulose-7-phosphate

193. Choose the reaction of substrate-level phosphorylation:
   a) 3-phosphoglycerate ---> 2-phosphoglycerate
   b) glucose-6-phosphate + H2O ---> glucose + H3PO4
   c) oxaloacetate + GTP ---> phosphoenolpyruvate + CO2 + GDP
   d) 1,3-bisphosphoglycerate + ADP ---> 3-phosphoglycerate + ATP
   e) 6-phosphogluconate + NADP ---> ribulose-5-phosphate + HADPH2 + CO2
194. In which tissue the gluconeogenesis is most active?
   a) liver
   b) adipose tissue
   c) skeletal muscles
   d) brain
   e) erythrocytes

195. In which tissue the pentose cycle is most active?
   a) skeletal muscles
   b) malignant tumor
   c) liver
   d) brain
   e) erythrocytes

196. What is the Pasteur effect?
   a) inhibition of tissue respiration by glycolysis
   b) inhibition of glycolysis by tissue respiration
   c) inhibition of pyruvate to lactate conversion
   d) activation of substrate-level phosphorylation in glycolysis
   e) stimulation of glycolysis by high concentration of ADP

197. After digestion of a piece of cake that contains flour, milk, and sucrose as its primary ingredients, the major carbohydrate products entering the blood are:
   a) glucose
   b) fructose and galactose
   c) glucose, fructose, and galactose
   d) galactose and glucose
   e) fructose and glucose

**PART 4. LIPID METABOLISM**

198. Which structure corresponds to cholic acid?
   a) 3,7-dioxycholanic acid
   b) 3,12-dioxycholanic acid
   c) 3,7,12-trioxycholanic acid
   d) 3,6,12-trioxycholanic acid
   e) 3-lithocholic acid

199. What structure corresponds to deoxycholic acid?
   a) 3,7-dioxycholanic acid
   b) 3,12-dioxycholanic acid
   c) 3,7,12-trioxycholanic acid
   d) 3-lithocholic acid
   e) 3,6,12-trioxycholanic acid

200. What structure corresponds to chenodeoxycholic acid?
   a) 3,7-dioxycholanic acid
   b) 3,7,12-trioxycholanic acid
c) 3,12-dioxycholanic acid
d) 3-lithocholic acid
e) 3,6,12-trioxycholanic acid

201. The transport form of exogenous triglycerides:
   a) chylomicrons
   b) VLDL
   c) HDL
   d) LDL
   e) albumins

202. The transport form of endogenous triglycerides:
   a) chylomicrons
   b) VLDL
   c) HDL
   d) LDL
   e) albumins

203. The transport form of cholesterol from liver to peripheric cells:
   a) LDL
   b) chylomicrons
   c) HDL
   d) albumins

204. The transport form of cholesterol from peripheric cells to liver:
   a) chylomicrons
   b) VLDL
   c) LDL
   d) HDL
   e) albumins

205. Free fatty acids are transported in blood with:
   a) chylomicrons
   b) VLDL
   c) HDL
   d) LDL
   e) albumins

206. What is energy yield of acyl-CoA oxidation up to enoyl-CoA?
   a) 2 ATP
   b) 12 ATP
   c) 15 ATP
   d) 20 ATP

207. What enzyme catabolizes VLDL?
   a) pancreatic lipase
   b) enteric lipase
   c) lipoprotein lipase
d) triglyceride lipase
e) phospholipases

208. What substance is lacking in the scheme of reaction:
\[
\text{Acetyl-CoA} + \text{CO}_2 + \text{ATP} \rightarrow \text{ADP} + \text{P}_i + ....
\]
a) acetyl-CoA
b) acyl-CoA
c) butyryl-CoA
d) malonyl-CoA

209. What substance is lacking in the scheme of reaction
\[
\text{acyl-CoA} + \text{FAD} \rightarrow ... + \text{FADH}_2
\]
a) acetyl-CoA
b) butyryl-CoA
c) enoyl-CoA
d) malonyl-CoA
e) β-hydroxyacyl-CoA

210. What substance is lacking in the scheme of reaction
\[
\text{β-hydroxyacyl-CoA} + \text{NAD}^+ \rightarrow .... + \text{NADH} + \text{H}^+
\]
a) acetyl-CoA
b) acyl-CoA
c) butyryl-CoA
d) enoyl-CoA
e) β-ketoacyl-CoA

211. What substance is lacking in the scheme of reaction
\[
\text{R-CO-CH}_2-\text{CO-SCoA} + \text{KoASH} \rightarrow \text{R-CO-SCoA} + ...
\]
a) acetyl-CoA
b) acyl-CoA
c) β-ketoacyl-CoA
d) malonyl-CoA
e) enoyl-CoA
f) succinyl-CoA

212. What substance is lacking in the scheme of reaction
\[
\text{oxaloacetate} + ... \rightarrow \text{citrate} + \text{HSCoA}
\]
a) acetyl-CoA
b) β-ketoacyl-CoA
c) malonyl-CoA
d) butyryl-CoA
e) enoyl-CoA

213. The cholesterol is the precursor of:
a) acetyl-CoA
b) bile acids
c) fatty acids
d) reproduction vitamin
214. Atherogenic lipoproteids:
   a) chylomicrons
   b) HDL
   c) LDL
   d) micelles

215. Antiatherogenic lipoproteids:
   a) chylomicrons
   b) HDL
   c) LDL
   d) VLDL

216. Which lipoproteids are precursors of LDL?
   a) chylomicrons
   b) HDL
   c) VLDL

217. The main fatty acids catabolism pathway is:
   a) decarboxylation
   b) reduction
   c) α-oxidation
   d) β-oxidation
   e) ω-oxidation

218. Which lipoprotein consists of protein - 2%, triglycerides - 85%, phosphatides - 7%,
     cholesterol - 2%, cholesteryl esters - 4%?
   a) chylomicrons
   b) LDL
   c) VLDL
   d) HDL

219. Which lipoprotein consists of protein - 10%, triglycerides - 50%, phosphatides - 18%,
     cholesterol - 7%, cholesteryl esters - 15%?
   a) chylomicrons
   b) HDL
   c) LDL
   d) VLDL

220. Which lipoprotein consists of protein - 25%, triglycerides - 7%, phosphatides - 21%,
     cholesterol - 7%, cholesteryl esters - 40%?
   a) chylomicrons
   b) HDL
   c) LDL
   d) VLDL
221. Which lipoprotein consists of protein - 45%, triglycerides - 5%, phosphatides - 25%, cholesterol - 5%, cholesteryl esters - 20%?
   a) chylomicrons
   b) HDL
   c) LDL
   d) VLDL

222. Which lipoprotein contains the enzyme LCAT?
   a) HDL
   b) VLDL
   c) LDL
   d) chylomicrons

223. Choose the structure of ketone bodies:
   a) CH$_3$-CO-CH$_2$-COOH
   b) CH$_3$-CH$_2$-CH$_2$-COOH
   c) CH$_3$-CO-S-CoA

224. Which enzyme catalyzes the reaction:
   \[ \text{CH}_3\text{-CO-S-CoA} + \text{CH}_3\text{-CO-S-CoA} \rightarrow \text{CH}_3\text{-CO-CH}_2\text{-CO-S-CoA} + \text{HSCoA} \]?
   a) thiokinase
   b) 3-ketothiolase
   c) acetyl-CoA-carboxylase
   d) hydroxy-methyl-glutaryl-CoA-reductase
   e) LCAT

225. Which enzyme catalyzes the reaction:
   \[ \text{CH}_3\text{-CO-S-CoA} + \text{HCO}_3^- + \text{ATP} \rightarrow \text{COOH-CH}_2\text{-CO-S-CoA} + \text{ADP} + \text{P}_i \]?
   a) hydroxy-methyl-glutaryl-CoA-reductase
   b) thiokase
   c) acetyl-CoA-carboxylase
   d) thiokinase
   e) cholesterolesterase
   f) LCAT

226. Which enzyme catalyzes the reaction:
   \[ \beta\text{-OH, }\beta\text{-CH}_3\text{-glutaryl-CoA} + 2 \text{NADPH} + \text{H}^+ \rightarrow \text{mevalonate} + 2 \text{NADP}^+ \]?
   a) thiokase
   b) thiokinase
   c) acetyl-CoA-carboxylase
   d) cholesterolesterase
   e) LCAT
   f) HMG-CoA-reductase

227. Which enzyme catalyzes the reaction:
   \[ \text{R-OOH} + \text{ATP} + \text{HSCoA} \rightarrow \text{R-CO-SCoA} + \text{AMP} + \text{PP}_i \]?
   a) thiokase
   b) LCAT
c) acetyl-CoA-carboxylase
d) acyl-CoA-synthetase
e) hydroxy-methyl-glutaryl-CoA-reductase
f) cholesterolesterase

228. Which enzyme catalyzes the reaction:
\[
\text{Cholesterol} + R-\text{CO-SCoA} \leftrightarrow \text{cholesterol ether} + \text{HS-CoA}
\]
a) thiokinase
b) thiolase
c) LCAT
d) ACAT
e) acetyl-CoA-carboxylase
f) hydroxy-methyl-glutaryl-CoA-reductase

229. Which enzyme catalyzes the reaction:
\[
\text{CH}_3\text{-CO-CH}_2\text{-COSCoA} + \text{CH}_3\text{-CO-SCoA} \rightarrow \beta\text{-hydroxy-}\beta\text{-methyl-glutaryl-SCoA}
\]
a) thiokinase
b) thiolase
c) acetyl-CoA-carboxylase
d) HMG-CoA-reductase
e) HMG-CoA synthase
f) cholesterolesterase

230. Which enzyme catalyzes the reaction:
\[
\text{Glycerol} + \text{ATP} \rightarrow \alpha\text{-glycerol phosphate} + \text{ADP}
\]
a) glycerol kinase
b) glycerol-3-phosphate dehydrogenase
c) glyceraldehydes-3-phosphate dehydrogenase
d) phosphoglycerate kinase
e) phosphoglyceromutase

231. Which cytoplasmic enzyme catalyzes the reaction:
\[
\text{Glycerol-3-phosphate} + \text{NAD}^+ \rightarrow \text{DHAP} + \text{NADH} + \text{H}^+
\]
a) glyceraldehyde phosphate dehydrogenase
b) phosphoglycerate kinase
c) phosphoglycerate mutase
d) glycerol kinase
e) glycerol-3-phosphate dehydrogenase

232. What is the energy yield of complete glycerol oxidation?

\begin{itemize}
  \item a) 2 ATP
  \item b) 12 ATP
  \item c) 15 ATP
  \item d) 22 ATP
  \item e) 36 ATP
\end{itemize}

233. Select the intermediate of ketone bodies synthesis:
\begin{itemize}
  \item a) malonyl-CoA
b) β-hydroxybutyrate
c) β-hydroxy-β-methyl-glutaryl-CoA
d) succinyl-CoA
e) acetoacetate

234. The biological role of ketone bodies is:
a) plastic material
b) structural component of the cell
c) energy source
d) cholesterol transport

235. Which low-molecular weight nitrogen substance takes part in fatty acids transfer across the mitochondrial membrane?
a) carnitine
b) creatine
c) carnosine
d) serine
e) biotin
f) choline

236. What is the substance?:
(\(CH_3\)_3N+-CH_2-CH(OH)-CH_2-COOH)
a) ethanolamine
b) choline
c) carnosine
d) carnitine
e) acyl-carnitine

237. Which nitrogen compound takes part in acetyl-CoA carboxylation while synthesis of fatty acids?
a) carnitine
b) serine
c) biotin
d) creatine
e) carnosine
f) methionine
g) choline

238. Which substance prevents fatty liver?
a) carnitine
b) creatine
c) carnosine
d) biotin
e) methionine

239. The first reaction in glycerol metabolism:
a) phosphorylation
b) reduction
c) oxidation  
d) acylation  
e) methylation

240. Which macroergic compound takes part in the complex lipids synthesis?  
a) GTP  
b) UTP  
c) CTP  
d) TTP  
e) ATP

241. Which substance is common metabolite while synthesis of fat and phosphatides:  
a) diacylglycerol  
b) 1,3-diphosphoglyceric acid  
c) mevalonic acid  
d) phosphatidic acid  
e) glycerophosphate

242. Which coenzyme supplies hydrogens for fatty acids and cholesterol biosynthesis?  
a) NADH + H⁺  
b) NADPH₂  
c) FADH₂  
d) FMNH₂  
e) glutathione-SH

243. How many turns of β-oxidation cycles make 20 carbon fatty acid?  
a) 8  
b) 9  
c) 10  
d) 11  
e) 12

244. How many turns of β-oxidation cycles make 16 carbon fatty acid?  
a) 7  
b) 8  
c) 9  
d) 10  
e) 11

245. Biochemical functions of LCAT are:  
a) esterification of cholesterol  
b) hydrolysis of cholesteryl esters  
c) synthesis of cholesterol  
d) synthesis of lecitine  
e) transport of cholesterol
246. Which enzyme catalyzes the reaction?

\[ \text{H}_2\text{N-CH}_2\text{CH}_2\text{OH} + \text{ATP} \rightarrow \text{H}_2\text{N-CH}_2\text{CH}_2\text{O-PO}_3\text{H}_2 + \text{ADP} \]

a) ethanolamine kinase  

b) choline kinase  

c) glycerol kinase  

d) serine kinase

247. Select the correct sequence of transformation on the pathways of fatty acids synthesis:

a) acetoacetyl-ACP, malonyl-ACP, acetyl-ACP, β-hydroxybutyryl-ACP, crotonyl-ACP, butyryl-ACP  

b) acetyl-ACP, butyryl-ACP, acetoacetyl-ACP, β-hydroxybutyryl-ACP, crotonyl-ACP, malonyl-ACP  

c) acetyl-ACP, malonyl-ACP, acetoacetyl-ACP, butyryl-ACP, crotonyl-ACP, β-hydroxybutyryl-ACP  

d) acetyl-ACP, malonyl-ACP, acetoacetyl-ACP, β-hydroxybutyryl-ACP, crotonyl-ACP, butyryl-ACP  

e) malonyl-ACP, acetoacetyl-ACP, β-hydroxybutyryl-ACP, crotonyl-ACP, acetyl-ACP, butyryl-ACP

248. Select the correct sequence of metabolites of fatty acids β-oxidation:

a) acetyl-CoA, fatty acid, enoyl-CoA, β-hydroxyacyl-CoA, β-ketoacyl-CoA, acyl-CoA  

b) fatty acid, acyl-CoA, acetyl-CoA, β-hydroxyacyl-CoA, β-ketoacyl-CoA, enoyl-CoA  

c) fatty acid, acyl-CoA, enoyl-CoA, acetyl-CoA, β-hydroxyacyl-CoA, β-ketoacyl-CoA  

d) fatty acid, acyl-CoA, enoyl-CoA, β-hydroxyacyl-CoA, β-ketoacyl-CoA, acetyl-CoA  

e) fatty acid, acyl-CoA, enoyl-CoA, β-ketoacyl-CoA, β-hydroxyacyl-CoA, acetyl-CoA

249. Phosphatidyl choline can be produced from phosphatidyl ethanolamine by mean of:

a) ATP  

b) carboxy-biotin  

c) choline  

d) CTP  

e) phosphatidate  

f) S-adenosyl methionine

250. Which diseases are due to abnormal cholesterol metabolism?

a) urolithiasis  

b) pheochromocytoma  

c) atherosclerosis  

d) sugar diabetes  

e) fatty liver

251. Select the correct sequence of metabolites of ketone bodies synthesis:

a) acetoacetyl-CoA, acetyl-CoA, β-hydroxy-β-methylglutaryl-CoA, acetoacetate, β-hydroxybutyrate  

b) acetyl-CoA, acetoacetate, β-hydroxy-β-methylglutaryl-CoA, acetoacetyl-CoA, β-hydroxybutyrate  

c) acetyl-CoA, acetoacetyl-CoA, β-hydroxybutyrate, acetoacetate, β-hydroxy-β-methylglutaryl-CoA
d) acetyl-CoA, acetoacetyl-CoA, β-hydroxy-β-methylglutaryl-CoA, acetoacetate, β-hydroxybutyrate

252. The substance shown is:
   HOOC-CH2-C(CH3)(OH)-CH2-CH2OH
   a) acetoacetyl-CoA
   b) malonyl-CoA
   c) mevalonic acid
   d) β-hydroxyacyl-CoA
   e) β-hydroxy-β-methylglutaryl-CoA

253. The substance shown is:
   R-CH2-CH=CH-CO-S-CoA
   a) acetoacetyl-CoA
   b) enoyl-CoA
   c) malonyl-CoA
   d) β-hydroxy-β-methylglutaryl-CoA
   e) β-ketoacyl-CoA

254. The substance shown is:
   R-CH2-CHOH-CH2-CO-S-CoA
   a) β-hydroxy-β-methylglutaryl-CoA
   b) acetoacetyl-CoA
   c) enoyl-CoA
   d) β-hydroxyacyl-CoA
   e) β-ketoacyl-CoA

255. The substance shown is:
   R-CH2-CO-CH2-CO-S-CoA
   a) acetoacetyl-CoA
   b) malonyl-CoA
   c) β-hydroxyacyl-CoA
   d) β-hydroxy-β-methylglutaryl-CoA
   e) β-ketoacyl-CoA

256. The substance shown is:
   HOOC-CH2-CO-S-CoA
   a) acetoacetyl-CoA
   b) enoyl-CoA
   c) malonyl-CoA
   d) β-hydroxyacyl-CoA
   e) β-ketoacyl-CoA

257. Which metabolic pathway encounters the reaction:
   Diacylglycerol phosphate + H2O → diacylglycerol + H3PO4
   a) biosynthesis of fatty acids
   b) biosynthesis of phosphatides
   c) biosynthesis of triglycerides
d) oxidation of fatty acids
e) oxidation of glycerol

258. What enzyme catalyzes reaction:
\[ \text{Diacylglycerol phosphate} + \text{H}_2\text{O} \rightarrow \text{Diacylglycerol} + \text{H}_3\text{PO}_4 \]
a) glycerol kinase
b) LCAT
c) lipoprotein lipase
d) phosphatidate phosphatase
e) phosphoenol carboxykinase

259. Which metabolic pathway encounters the reaction:
\[ \text{Diacylglycerol phosphate} + \text{CTP} \rightarrow \text{CDP-diacylglycerol} + \text{H}_4\text{P}_2\text{O}_8 \]
a) biosynthesis of fatty acids
b) biosynthesis of ketone bodies
c) biosynthesis of phosphatides
d) biosynthesis of triglycerides
e) oxidation of fatty acids

260. Mitochondrial Acetyl-CoA transfer to cytoplasm while synthesis of fatty acids occurs mainly...
   a) as citrate
   b) as malonyl-CoA
   c) by active transport with expense of ATP
   d) by means of carnitine
   e) with glycerolphosphate mechanism

261. Fill the gap in the equation:
\[ \text{CDP-ethanolamine} + \ldots \rightarrow \text{Phosphatidyl ethanolamine} + \text{CMP} \]
a) 1,2-diacylglycerol
b) ethanolamine
c) glycerine
d) glycerol-3-phosphate
e) serine

262. Select lipogenic (antilipolytic) hormones:
a) adrenalin
b) cortisol
c) glucagon
d) insulin
e) thyroxine

263. The normal blood serum cholesterol concentration is?
a) 0.6-1.0 g/l
b) 1.5-2.5 g/l
c) 2.0-5.0 g/l
d) 2.8-8.4 g/l
e) 3.3-5.5 g/l
264. The prevailing diurnal cholesterol source is:
   a) endogenous
   b) exogenous
   c) from steroid hormones
   d) from phospholipids
   e) from vitamins

265. The opacity of blood serum in the fed state is caused by the presence of...
   a) bile acids
   b) cholesterol
   c) phosphatides
   d) prostaglandins
   e) triacylglycerols

266. The absorption of lipids occurs mainly in:
   a) duodenum
   b) large intestine
   c) mouth
   d) small intestine
   e) stomach

267. Ketosis is the state of increased blood level of:
   a) acetoacetyl-CoA
   b) acetyl-CoA
   c) lactate
   d) acetate
   e) β-hydroxybutyrate

268. Acetyl-CoA carboxylase is...
   a) dehydrogenase
   b) liase
   c) ligase
   d) transferase
   e) hydrolase

269. Acetyl-CoA carboxylase is inhibited by...:
   a) avidine
   b) citrate
   c) carnitine
   d) lactalbumin
   e) NADH

270. Fatty acid C_{15} enters TCA as:
   a) citrate
   b) succinate
   c) malonyl-CoA
   d) succinyl-CoA
e) α-ketoglutarate

271. ApoB-100 is ...
   a) in HDL
   b) LCAT activator
   c) marker of chylomicrons
   d) LCAT inhibitor
   e) marker of LDL

272. ApoB-48 are markers of:
   c) chylomicrons
   g) VLDL
   h) LDL
   i) IDL
   j) HDL

273. Which enzyme catalyses VLDL catabolism?
   a) pancreatic lipase
   b) stomach lipase
   c) phospholipase
   d) lipoprotein lipase
   e) triglyceride lipase

274. Which of the following proteolytic enzymes has the greatest effect on the activity of other proteolytic enzymes involved in digestion?
   a) pepsin
   b) trypsin
   c) chymotrypsin
   d) carboxypeptidase A
   e) aminopeptidase

275. The compound shown below
     \[
     \text{NH}_2\text{-CO-CH}_2\text{-CH}_2\text{-CH(NH}_2\text{)-COOH}
     \]
   a) is an intermediate in the urea cycle
   b) releases two moles of ammonia when converted to one mole of α-ketoglutarate
   c) is formed by transamination of oxaloacetate
   d) is the amino acid lysine
   e) contains two amino groups

276. In the urea cycle:
   a) carbamoyl phosphate is derived directly from glutamine and CO\textsubscript{2}
   b) ornithine reacts with aspartate to generate argininosuccinate
   c) ornithine directly reacts with carbamoyl phosphate to form citrulline
   d) the α-amino group of arginine forms one of the nitrogens of urea
   e) N-acetylglutamate is a positive allosteric effector of ornithine transcarbamoylase
277. Each of the following enzymes is involved in the synthesis of serine from glucose EXCEPT
a) aldolase
b) phosphofructokinase
c) pyruvate kinase
d) phosphoserine phosphatase
e) glyceraldehyde 3-phosphate dehydrogenase

278. A common intermediate on the synthesis of arginine, serine, and aspartate from glucose is
a) oxaloacetate
b) pyruvate
c) α-ketoglutarate
d) glyceraldehyde 3-phosphate
e) ornithine

279. Via enzymes of the urea cycle, aspartate...
a) provides nitrogen for synthesis of arginine
b) provides carbon for the synthesis of arginine
c) is decarboxylated
d) is converted to malate
e) is converted to oxaloacetate

280. Which of the following statements concerning glutamate is TRUE?
a) It is produced in a transamination reaction in which aspartate reacts with oxaloacetate
b) It undergoes a series of reactions in which is cyclizes to produce histidine
c) It can be converted to arginine by a series of reactions, some of which require urea cycle enzymes
d) It is produced by the action of glutamate dehydrogenase, an enzyme that requires NH₄⁺ and FAD
e) It is essential amino acid

281. Each of the following statements about serine is correct EXCEPT:
a) It is converted to pyruvate and ammonia by a dehydratase
b) It is the only amino acid that contains a hydroxyl group
c) It may be synthesized from glucose via a glycolytic intermediate
d) It is converted to glycine by a reaction requiring tetrahydrofolic acid
e) It is a nonessential amino acid

282. Pyridoxal phosphate is required for the enzymes catalyzing the reaction:
a) pyruvate + glutamate → alanine + α-ketoglutarate
b) glutamate + NAD⁺ → α-ketoglutarate + NH₄⁺ + NADH + H⁺
c) glutamate + NH₃ + ATP → glutamine + ADP + P₁
d) glutamine + H₂O → glutamate + NH₃

283. The carbons of cysteine are derived from:
a) leucine
b) tryptophan
c) serine
d) threonine
284. Isocitrate dehydrogenase is required for the synthesis from glucose of the amino acid
a) alanine  
b) aspartate  
c) cysteine  
d) glutamate  
e) serine

285. During the metabolism of the branched-chain amino acids
a) leucine is converted to acetoacetate only  
b) isoleucine is converted to acetoacetate only  
c) lipoic acid is not required  
d) none of the carbons of isoleucine is converted to succinyl-CoA  
e) valine is deaminated rather than transaminated

286. The major amino acid that is released from muscle and converted to glucose in liver is:
a) aspartate  
b) glutamate  
c) glutamine  
d) valine  
e) alanine

287. Each of the following statements about the kidney is correct EXCEPT:
a) it converts glutamine to α-ketoglutarate  
b) it synthesizes most of the urea that is excreted into the urine  
c) it produces serine and alanine and releases them into the blood  
d) it uses ammonia released from glutamine to buffer acids in the urine

288. De novo pyrimidine synthesis requires:
a) both carbon and nitrogen of aspartate to form the ring  
b) glycine as the source of two nitrogens in the ring  
c) NH₄⁺ as a substrate for carbamoyl phosphate synthetase II  
d) phosphoribosyl pyrophosphate (PRPP) for the initial step  
e) tetrahydrofolate for the incorporation of carbons 2 and 8

289. The principal nitrogenous urinary excretion product in humans resulting from the catabolism of AMP is:
a) creatinine  
b) thiamine  
c) thymine  
d) urea  
e) uric acid

290. The conversion of propionyl CoA to succinyl CoA requires:
a) biotin  
b) vitamin B₁₂  
c) tetrahydrofolate
d) biotin and vitamin B\textsubscript{12}

e) biotin, vitamin B\textsubscript{12}, and tetrahydrofolate

291. S-Adenosylmethionine (SAM) serves as the methylating agent for each of the following EXCEPT:
a) the conversion of dUMP to dTMP
b) the synthesis of phosphatidylcholine from phosphatidylethanolamine
c) the conversion of norepinephrine to epinephrine
d) the synthesis of creatine from guanidinoacetate
e)

292. Glycine is an important precursor in the pathway for the biosynthesis of each of the following EXCEPT:
a) valine
b) creatine
c) guanine
d) heme
e)

293. Each of the following statements about nitrogen metabolism is correct EXCEPT:
a) formiminoglutamate (FIGLU) is an intermediate in glutamine degradation
b) creatine phosphate contains a high energy bond
c) creatine requires glycine, arginine, and methionine for synthesis of its carbon skeleton

d) phosphatidyl choline from diacylglycerol and CDP-choline

294. Pregnant women frequently suffer from folate deficiencies. A deficiency of folate would decrease the production of
a) all of the pyrimidines required for RNA synthesis
b) the thymine nucleotide required for DNA synthesis
c) creatine phosphate from creatine
d) phosphatidyl choline from diacylglycerol and CDP-choline

295. Compared to a healthy person, a person with pernicious anemia
a) produces less intrinsic factor
b) excretes less methylmalonic acid in the urine
c) requires less methionine in the diet
d) has a higher rate of purine biosynthesis
e) has lower blood levels of FIGLU

296. A 24-hour urine collection showed that an individual's excretion of creatinine was much lower than normal. Decreased excretion of creatinine could be caused by
a) kidney failure
b) decreased dietary intake of creatine
c) a higher than normal muscle mass resulting from weight lifting
d) a genetic defect in the enzyme that converts creatine phosphate to creatinine

297. A genetic defect in the ability to synthesize tetrahydrobiopterin would affect each of the following conversions EXCEPT
a) dopa to melanin
b) phenylalanine to tyrosine
c) tryptophan to serotonin
d) tyrosine to dopamine
e)

298. Phenylketonuria, alcaptonuria, and albinism are caused by deficiencies in enzymes involved in the metabolism of...
   a) tyrosine
   b) histidine
   c) lysine
d) tryptophan
e) valine

299. The plasma and urine of patients with maple syrup urine disease contain elevated levels of each of the following amino acids EXCEPT:
   a) lysine
   b) isoleucine
   c) leucine
d) valine

300. The most likely elevated component in the blood in gout:
   a) uric acid
   b) bilirubin
c) creatine phosphokinase
d) blood urea nitrogen (BUN)

301. The most likely elevated component in the blood in kidney disease
   a) Blood urea nitrogen (BUN)
   b) Bilirubin
c) Uric acid
d) Creatine phosphokinase

302. Is synthesized by intestinal cells
   a) Enteropeptidase
   b) Pepsin
c) Trypsin
d) Carboxypeptidase A

303. Cleaves bonds at the carboxyl end of the arginine and lysine residues within a polypeptide chain
   a) Trypsin
   b) Pepsin
c) Carboxypeptidase A
d) Enteropeptidase

304. Acts as an exopeptidase
   a) Carboxypeptidase A
   b) Pepsin
c) Trypsin
d) Enteropeptidase
e)

305. Is produced by the action of HCl on its precursor
a) Pepsin
b) Trypsin
c) Carboxypeptidase A
d) Enteropeptidase
e

306. Is produced by cleavage of cystathionine
a) Cysteine
b) Serine
c) Threonine
d) Methionine

307. Contains a carbon skeleton that can be converted to pyruvate by a single enzyme
a) Serine
b) Cysteine
c) Threonine
d) Methionine

308. Can be converted to glycine in a single reaction that requires tetrahydrofolate
a) Serine
f) Cysteine
g) Threonine
a) Methionine

309. Contains a carbon skeleton that can be converted to homocysteine
a) Methionine
b) Serine
c) Cysteine
d) Threonine

310. Required for the decarboxylation of the transamination product of valine
a) Pyridoxal phosphate
b) Vitamin B12
c) Tetrahydrofolate (FH4)
d) Biotin
e) Thiamine

311. Required for the synthesis of deoxythymidylate from deoxyuridylate
a) Tetrahydrofolate (FH4)
b) Vitamin B12
c) Biotin
d) Thiamine
e) Pyridoxal phosphate

312. Directly required for the synthesis of serine from glycine
a) Tetrahydrofolate (FH4)
b) Vitamin B12
c) Biotin
d) Thiamine
e) Pyridoxal phosphate

313. Directly required for the conversion of methylmalonyl CoA to succinyl CoA
a) Vitamin B12
b) Tetrahydrofolate (FH4)
c) Biotin
d) Thiamine
e) Pyridoxal phosphate

314. Required for the conversion of histidine to histamine
a) Pyridoxal phosphate
b) Vitamin B12
c) Tetrahydrofolate (FH4)
d) Biotin
e) Thiamine

315. Can be converted to epinephrine
a) Tyrosine
b) Tryptophan
c) Threonine
d) Thymine

316. Contains nonring carbons that can be cleaved from the ring structure to form alanine
a) Tryptophan
b) Tyrosine
c) Threonine
d) Thymine

317. Is synthesized by hydroxylation of an essential amino acid
a) Tyrosine
b) Tryptophan
c) Threonine
d) Thymine

318. May be converted to serotonin by reactions requiring tetrahydrobiopterin and molecular oxygen
a) Tryptophan
b) Tyrosine
c) Threonine
d) Thymine

319. May be converted to the moiety of NAD\(^+\) that may also be derived from niacin
a) Tryptophan
b) Tyrosine
c) Threonine
d) Thymine

320. May be produced from uracil
   a) Thymine
   b) Tyrosine
   c) Tryptophan
   d) Threonine

321. The compound related to NAD$^+$
   a) Tryptophan
   b) Leucine
   c) Homocysteine
   d) Glutamate

322. The compound related to HMG CoA
   a) Leucine
   b) Homocysteine
   c) Glutamate
   d) Tryptophan

323. The compound related to proline
   a) Glutamate
   b) Leucine
   c) Homocysteine
   d) Tryptophan

324. The compound related to methionine
   a) Homocysteine
   b) Leucine
   c) Glutamate
   d) Tryptophan

325. Serotonin is derived from
   a) Tryptophan
   b) Glutamate
   c) Tyrosine
   d) Histidine

326. Gamma-Aminobutyric acid (GABA) is derived from
   a) Glutamate
   b) Tyrosine
   c) Histidine
   d) Tryptophan

327. Histamine is derived from
   a) Histidine
   b) Glutamate
c) Tyrosine  
d) Tryptophan

328. Epinephrine is derived from
a) Tyrosine  
b) Glutamate  
c) Histidine  
d) Tryptophan

329. In DNA, on a molar basis
a) adenine equals thymine  
b) adenine equals uracil  
c) guanine equals adenine  
d) cytosine equals thymine  
e) cytosine equals uracil

330. Which of the following sequences is complementary to the DNA sequence 5'-AAGTCCGA-3'?

a) 3'-TTCAGGCT-5'  
b) 5'-AAGUCCGA-3'  
c) 5'-TTCAGGCT-3'  
d) 3'-TCGGACTT-5'

331. DNA contains which one of the following components?

a) Base pairs stacked along the central axis of the molecule  
b) Nitrogenous bases joined by phosphodiester bonds  
c) Negatively charged phosphate groups in the interior of the molecule  
d) Two strands that run in the same direction  
e) The sugar ribose

332. Which RNA contains 7-methylguanine at the 5' end?

a) hnRNA  
b) 5S RNA  
c) rRNA  
d) tRNA

333. Thymine is present in which type of RNA?

a) tRNA  
b) mRNA  
c) rRNA  
d) hnRNA

334. The action of DNA polymerases requires

a) a 3'-hydroxyl group  
b) a 5'-hydroxyl group  
c) dUTP  
d) NAD+ as a cofactor  
e) CTP
335. Which of the following statements concerning replication of DNA is TRUE?
   a) It progresses in both directions away from each point of origin on the chromosome
   b) It requires a DNA template that is copied in its 5' to 3' direction
   c) It occurs during the M phase of the cell cycle
   d) It produces one newly synthesized double helix and one composed of the two parental strands

336. When base-pairing occurs in loops of RNA, adenine is hydrogen-bonded to
   a) uracil
   b) guanine
   c) thymine
   d) cytosine

337. Which of the following statements concerning Okazaki fragments is TRUE?
   a) They are relatively short polydeoxyribonucleotides with a few ribonucleotide residues at the 5' end
   b) They are produced by restriction enzymes
   c) They are synthesized on the leading strand during replication
   d) They are regions of DNA that do not code for the amino acids in a protein
   e) They are products of the action of RNase on hnRNA

338. A bacterial mutant grows normally at 32°C but at 42°C accumulates short segments of newly synthesized DNA. Which of the following enzymes is most likely to be defective in this mutant?
   a) Polynucleotide ligase
   b) An endonuclease
   c) DNA polymerase
   d) An exonuclease
   e) An unwinding enzyme (helicase)

339. Which of the following phrases describes nucleosomes?
   a) Subunits of chromatin
   b) Single ribosomes attached to mRNA
   c) Complexes of DNA and all the histones except H4
   d) Structures that contain DNA in the core with histones wrapped around the surface
   e) Complexes of protein and the 45S rRNA precursors found in the nucleolus

340. In an embryo that lacked nucleoli, the synthesis of which type of RNA would be most directly affected?
   a) rRNA
   b) tRNA
   c) mRNA
   d) 5S RNA
   e) hnRNA

341. Eukaryotic genes that produce mRNA
   a) may contain a CAAT box in the 5' flanking region
   b) contain a TATA box downstream from the start site of transcription
c) are transcribed by RNA polymerase III

d) contain long stretches of thymine nucleotides that produce the poly(A) tail of mRNA

e) do not contain intervening sequences or introns

342. If a fragment of DNA containing the sequence 5'-AGCCAAATT-3' serves as the template for transcription, the RNA that is produced will have the sequence

a) 5'-AAUUGGCU-3'
b) 5'-AGCCAAUUU-3'
c) 5'-UCGGUUAAA-3'
d) 5'-UUAACCGA-3'

343. A person ate mushrooms picked in a wooded area. Shortly thereafter, he was rushed to the hospital, where he died. He had no previous medical problems. The cause of his death was most likely the RNA polymerase inhibitor

a) α-amanitin
b) rifampicin
c) streptolydigin
d) actinomycin D

344. When benzo(a)pyrene (a carcinogen in cigarette smoke) binds to DNA, it forms a bulky covalent adduct on guanine residues. The consequence is that

a) a repair process usually removes and replaces the damaged region of DNA
b) cells are rapidly transformed into cancer cells
c) glycosylases remove the benzpyrene residues
d) UV light cleaves the benzpyrene from the guanine residue

345. Patients with xeroderma pigmentosum suffer DNA damage when they are exposed to UV light because UV light causes the formation of

a) pyrimidine dimers in DNA
b) purine dimers in DNA
c) deoxyribose dimers in DNA
d) anhydride bonds between phosphate groups in DNA

346. Patients with xeroderma pigmentosum develop skin cancer when they are exposed to sunlight because they have a deficiency in

a) an enzyme that acts early in the excision repair pathway
b) primase
c) recombinase
d) glycosylase
e) an enzyme essential to repair mismatched bases

347. A common mutagenic event is the deamination of cytosine in DNA to form uracil. If the damaged strand is replicated, a CG base pair in DNA will be converted to a

a) TA base pair
b) GC base pair
c) GG base pair
d) UG base pair
348. If cytosine in DNA is deaminated, the uracil residue that results may be removed by
a) a glycosylase
b) an endonuclease
c) an exonuclease
d) polynucleotide ligase
e) a repair DNA polymerase

349. An aminoacyl-tRNA exhibits which one of the following characteristics?
 a) It contains an anticodon that is complementary to the codon for the amino acid
 b) It is produced by a synthetase that is specific for the amino acid, but not the tRNA
 c) It is composed of an amino acid esterified to the 5' end of the tRNA
 d) It requires GTP for its synthesis from an amino acid and a tRNA

350. Which one of the following point mutations would NOT produce a change in the protein translated from an mRNA?
 a) UCA->UCU
 b) UCA->UAA
 c) UCA->CCA
 d) UCA->ACA
 e) UCA->GCA

351. Which of the following statements about methionine is TRUE?
 a) It is the amino acid used for initiation of the synthesis of proteins
 b) It is generally found at the N-terminus of proteins isolated from cells
 c) It requires a codon other than AUG to be added to growing polypeptide chains
 d) It is formylated when it is bound to tRNA in eukaryotic cells

352. Which of the following statements about bacteria is correct?
 a) They synthesize proteins on mRNA that is in the process of being transcribed
 b) They contain 80S ribosomes
 c) They initiate protein synthesis with methionyl-tRNA
 d) They are insensitive to chloramphenicol

353. Which of the following is NOT required for initiation of protein synthesis in the cytoplasm of eukaryotic cells?
 a) EF-2
 b) a 40S ribosomal subunit
 c) eIF-2
 d) Methionyl-tRNAiMet
 e) GTP

354. Which of the following is NOT required for the elongation reactions of protein synthesis in eukaryotes?
 a) Formylmethionyl-tRNA
 b) peptidyl transferase
 c) GTP
 d) Elongation factor 2 (EF-2)
 e) mRNA
355. The mechanism for termination of protein synthesis in eukaryotes requires
a) release factors
b) a peptidyl-tRNA that cannot bind at the P site
c) the codon UGA, UAG, or AUG in the A site
d) nuclease cleavage of mRNA

356. Proteins that are secreted from cells
a) are synthesized on ribosomes that bind to proteins on the endoplasmic reticulum
b) contain methionine as the N-terminal amino acid
c) are produced from translation products that have a signal sequence at the C-terminal end
d) contain a hydrophobic sequence at the C-terminal end that is embedded in the membrane of secretory vesicles
e) contain carbohydrate residues that bind to receptors on the interior of lysosomal membranes

357. Tetracycline, streptomycin, and erythromycin are effective antibiotics because they inhibit
a) protein synthesis in prokaryotes
b) RNA synthesis in prokaryotes
c) RNA synthesis in eukaryotes
d) protein synthesis on cytoplasmic ribosomes in eukaryotes
e) protein synthesis on mitochondrial ribosomes in eukaryotes

Part 6. Biochemistry of Vitamins and Hormones

358. What vitamin protects the ascorbic acid from oxidation?
   a) P
   b) Folic acid
   c) B12
   d) K

359. What vitamin is most widely applied in complex therapy of neuritis and polyneuritis?
   a) B1
   b) K
   c) B6
   d) C

360. What vitamin participates in transketolase reactions of nonoxidative part of pentose phosphate pathway?
   a) B1
   b) B6
   c) B12
   d) C

361. Derivative of what vitamin participates in transporting of protons and electrons through mitochondrial ETC, but is absent in microsomal ETC?
   a) PP
   b) B6
   c) B1
   d) B2
362. Biotin takes part in what type of reactions:
   a) carboxylation
   b) transamination
   c) decarboxylation

363. What vitamin is necessary for dehydrogenase reactions by peroxidase pathway?
   a) B2
   b) B6
   c) B1
   d) B12

364. Specify coenzyme forms of vitamin B12:
   a) 5-deoxyadenosylcobalamine
   b) cyanocobalamine
   c) hydroxocobalamine

365. What vitamin is necessary for histidine to histamine transformation?
   a) B6
   b) B1
   c) B2
   d) C

366. What vitamin prevents the degradation of acetylcholine?
   a) B1
   b) C
   c) B2
   d) B6

367. What vitamin is needed for propionyl-CoA to methylmalonyl-CoA transformation?
   a) H
   b) C
   c) B6
   d) B12

368. What vitamin participate methyltransferase reactions?
   a) folic acid
   b) B1
   c) B6
   d) C

369. What substance IS NOT vitamin-like substances?
   a) creatine
   b) inositol
   c) carnitine
   d) orotic acid
370. What vitamin is anti-seborrhean factor?
   a) H  
   b) B6  
   c) B2  
   d) E

371. Riboflavin is vitamin:
   a) of growth  
   b) anti-neuritis  
   c) anti-anemia  
   d) anti-dermatitis

372. Lack of which vitamin does not result in anemia?
   a) B1  
   b) folic acid  
   c) B12

373. What vitamin would be in great demand while excess protein intake?
   a) B6  
   b) B1  
   c) D  
   d) PP

374. What form of vitamin A causes its toxic effect?
   a) free-form  
   b) bound  
   c) β-form

375. Is retinal transformation to retinoic acid reversible?
   a) No  
   b) Yes

376. What symptom is not characteristic for hypervitaminosis D?
   a) Osteoporosis  
   b) Stop of growth  
   c) Calcification of internals  
   d) High arterial pressure

377. What element is a synergist with vitamin E?
   a) Se  
   b) Fe  
   c) Cu  
   d) Co

378. Where vitamin E is accumulated?
   a) fatty tissue  
   b) in muscular tissue
c) in kidneys

379. Synthesis of which blood-coagulation factors is not inhibited in hypovitaminosis K?
   a) III
   b) II
   c) VII
   d) IX
   e) X

380. What vitamin is needed for THFA formation?
   a) C
   b) B12
   c) H
   d) P

381. Which of the following acts to increase the release of Ca2+ from the endoplasmic reticulum?
   a) Inositol trisphosphate (IP3)
   b) Diacylglycerol (DAG)
   c) Parathyroid hormone (PTH)
   d) 1,25-Dihydroxycholecalciferol (1,25-DHC)

382. A dietary deficiency of iodine would
   a) result in increased secretion of thyroid stimulating hormone (TSH)
   b) directly affect the synthesis of thyroglobulin on ribosomes
   c) result in decreased production of thyrotropin releasing hormone (TRH)
   d) result in increased heat production

383. Which of the following is true of testosterone?
   a) May be converted to a more active androgen in its target cells
   b) Acts by binding to receptors on the cell surface
   c) Is produced from estradiol (E2)
   d) Stimulates the synthesis of gonadotropin releasing hormone (GnRH) by the hypothalamus

384. Which of the following is true of epinephrine?
   a) Is synthesized from tyrosine
   b) Acts only through the phosphatidylinositol bisphosphate system
   c) Causes the level of cAMP in liver cells to decrease
   d) Functions like a steroid hormone

385. GnRH stimulates the release of
   a) LH and FSH
   b) GH
   c) T3 and T4
   d) PRL
   e) IGF
386. A key intermediate for the synthesis of both testosterone and cortisol from cholesterol is
a) pregnenolone
b) 7-hydroxycholesterol
c) aldosterone
d) retinoic acid

387. In the synthesis of 1,25-DHC from 7-dehydrocholesterol
a) ultraviolet light is required
b) the steroid ring structure remains intact
c) cholesterol is an intermediate
d) three hydroxylations occur

388. Has its release inhibited by thyroxine
a) Thyroid stimulating hormone (TSH)
b) Luteinizing hormone (LH)
c) Prolactin (PRL)
d) Growth hormone (GH)
e) Follicle stimulating hormone (FSH)

389. Binds to receptors on Leydig cells
a) Luteinizing hormone (LH)
b) Prolactin (PRL)
c) Thyroid stimulating hormone (TSH)
d) Growth hormone (GH)
e) Follicle stimulating hormone (FSH)

390. Stimulates production of insulin-like growth factor (IGF)
a) Growth hormone (GH)
b) Luteinizing hormone (LH)
c) Prolactin (PRL)
d) Thyroid stimulating hormone (TSH)
e) Follicle stimulating hormone (FSH)

391. Stimulates the synthesis of milk proteins
a) Prolactin (PRL)
b) Luteinizing hormone (LH)
c) Thyroid stimulating hormone (TSH)
d) Growth hormone (GH)
e) Follicle stimulating hormone (FSH)

392. Stimulates the production of progesterone by the corpus luteum
a) Luteinizing hormone (LH)
b) Prolactin (PRL)
c) Thyroid stimulating hormone (TSH)
d) Growth hormone (GH)
e) Follicle stimulating hormone (FSH)
393. Stimulates the production of estradiol by the immature ovarian follicle
   a) Follicle stimulating hormone (FSH)
   b) Luteinizing hormone (LH)
   c) Prolactin (PRL)
   d) Thyroid stimulating hormone (TSH)
   e) Growth hormone (GH)

394. Action mediated by a second messenger
   a) Neither cortisol nor aldosterone
   b) Cortisol
   c) Aldosterone
   d) Both cortisol and aldosterone

395. Synthesized from cholesterol by cells of the adrenal cortex
   a) Both cortisol and aldosterone
   b) Cortisol
   c) Aldosterone
   d) Neither cortisol nor aldosterone

396. Receptors that have a DNA binding domain
   a) Both cortisol and aldosterone
   b) Cortisol
   c) Aldosterone
   d) Neither cortisol nor aldosterone

397. Associated with induction of phosphoenolpyruvate carboxykinase (PEPCK)
   a) Cortisol
   b) Aldosterone
   c) Both cortisol and aldosterone
   d) Neither cortisol nor aldosterone

398. Secreted in response to angiotensin II
   a) Aldosterone
   b) Cortisol
   c) Both cortisol and aldosterone
   d) Neither cortisol nor aldosterone

399. Produced by the anterior pituitary
   a) Neither oxytocin nor vasopressin
   b) Oxytocin
   c) Vasopressin
   d) Both oxytocin and vasopressin

400. Found associated with neurophysin in secretory granules
   a) Both oxytocin and vasopressin
   b) Oxytocin
   c) Vasopressin
   d) Neither oxytocin nor vasopressin
401. Associated with diuresis (acts as diuretic)
   a) Neither oxytocin nor vasopressin
   b) Oxytocin
   c) Vasopressin
   d) Both oxytocin and vasopressin

402. Produced from the proopiomelanocortin (POMC) gene
   a) Neither oxytocin nor vasopressin
   b) Oxytocin
   c) Vasopressin
   d) Both oxytocin and vasopressin

403. Each of the following statements concerning pyruvate dehydrogenase is true EXCEPT
   a) It produces oxaloacetate from pyruvate
   b) It is an example of a multienzyme complex
   c) It requires thiamine pyrophosphate as a cofactor
   d) It is converted to an inactive form by phosphorylation
   e) It is inhibited when NADH levels increase

404. Each of the following is the part of coenzyme A EXCEPT
   a) α-alanine
   b) Pantothenic acid
   c) B-mercaptoethylamine
   d) Adenosine-3',5'-bisphosphate

405. The cofactor for transketolase is derived from
   a) Thiamine
   b) Ascorbate
   c) Retinol
   d) Bioin
   e) Lipoic acid
   f) Ubiquinone

406. In the tricarboxylic acid cycle, thiamine pyrophosphate
   a) Forms a covalent intermediate with the α-carbon of α-ketoglutarate
   b) Accepts electrons from the oxidation of pyruvate and α-ketoglutarate
   c) Accepts electrons from the oxidation of isocitrate
   d) Forms a thioester with the sulphydryl group of CoASH
   e) Forms a thioester with the sulphydryl group of lipoic acid

407. Each of the following vitamins is required for reactions in the oxidation of pyruvate to CO2 and H2O EXCEPT
   a) Biotin
   b) Pantothenate
   c) Niacin
   d) Thiamine
   e) Riboflavin
408. The fraction of gamma-globulins encounters:
   a) immunoglobulin G
   b) fibrinogen
   c) lipoproteins
   d) transferrin
   e) α-2-macroglobulin

409. Determination the α-fetoprotein has diagnostic value at:
   a) primary cancer of liver
   b) infectious hepatitis
   c) carcinoma of the stomach
   d) the complicated myocardial infarction

410. Gamma-globulins producing cells are:
   a) plasma cells
   b) monocytes
   c) basophiles
   d) macrophages
   e) thrombocytes

411. The content of gamma globulins is decreased at:
   a) radiation disease
   b) ischemic heart disease
   c) gastritis
   d) appendicitis
   e) pseudorheumatism

412. The cause of paraproteinemia can be:
   a) multiple myeloma
   b) hemorrhagic diatheses
   c) hyperglycemia
   d) disproteinema

413. The blood fibrinogen decreases in:
   a) chronic liver diseases
   b) myocardial infarction
   c) rheumatic disease
   d) uremia
   e) acute inflammation

414. The decreased blood haptoglobin can be observed at:
   a) hemoglobinemia
   b) hypokalemia
   c) hyperbilirubinemia
   d) azotemia
415. To determine the rest nitrogen proteins had to be precipitated by:
   a) trichloroacetic acid
   b) caustic soda
   c) salicyl-sulphonic acid

416. Retention azotemias DO NOT OCCUR at:
   a) pneumonias
   b) acute nephritis
   c) chronic nephritis
   d) pyelonephritis

417. Extrarenal retention azotemias can be at:
   a) extensive burns
   b) gastritis
   c) peptic ulcer
   d) otitis
   e) pneumonias

418. Production azotemia arises at:
   a) thyrotoxicoses
   b) dehydration
   c) kidney problems

419. The rest nitrogen increases due to urea at:
   a) acute chronic renal failure
   b) acute hepatitis
   c) ischemic disease of heart
   d) hepatic cirrhosis
   e) acute yellow atrophy of liver

420. The source of creatine in the organism:
   a) synthesis in liver
   b) synthesis in erythrocytes
   c) enters the organism with nutrition
   d) synthesis in the central nervous system

421. The causes of hyperproteinemia are:
   a) dehydration of the organism
   b) overhydration
   c) decreased absorption of proteins in the intestines
   d) rising permeability of vascular membranes

422. The physiological roles of haptoglobin:
   a) binding of the hemoglobin
   b) participation in reaction of immunity
   c) participation in blood clotting
423. Concentration of ammonia in blood grows at:
   a) failures carbamoylphosphate synthetase
   b) decompensated sugar diabetes
   c) heart failure

424. The following blood protein shows antiprotease activity:
   a) α1-antitrypsin
   b) prekallikrein
   c) immunoglobulin E
   d) the plasma blood clotting factor IV

425. Protein, which transport steroid hormones:
   a) transcortin
   b) chondroproteid
   c) C-reactive protein
   d) transferrin

426. The acute phase protein, its revealing in blood signals about the exacerbation of chronic process.
   a) C-reactive protein
   b) chondroproteid
   c) transcortin

427. A symptom of porphyria
   a) photosensitization
   b) myoglobinuria
   c) methemoglobinemia

428. Methemoglobin in the organism can be reduced with the enzyme:
   a) reductase
   b) catalase
   c) cytochrome
   d) pepsin

429. Which jaundice result in the increased secretion of urobilinogen (stercobilinogen) with urine?
   a) hemolytic
   b) hepatocellular
   c) obstructive
   d) jaundice of the newborn
   e) congenital icterus

430. The properties of conjugated bilirubin
   a) water-soluble
   b) toxic
   c) practically water-insoluble
   d) impermeable through the renal barrier
431. Which component transports haptoglobin?
   a) hemoglobin
   b) iron
   c) copper
   d) albumen
   e) hormones

432. The lack of which protein promotes Konovalov-Wilson disease (liver and spleen dystrophy)?
   a) ceruloplasmin
   b) transcortin
   c) keratansulfate
   d) thyrotropin
   e) haptoglobin

433. The factor protecting the organism from the loss of endogenic iron:
   a) haptoglobin
   b) ceruloplasmin
   c) transcortin
   d) keratansulfate
   e) thyrotropin

434. Which substances can appear in the tissues and blood after the snake bite, which poison contains hyaluronidase?
   a) glucosamines
   b) galactose
   c) fucose

435. Patients with stomach peptic ulcer have their mucous mucoproteid degraded, because there is the superactivity of the enzyme:
   a) neuroamidinase
   b) hyaluronidase
   c) catalase

436. What is the function of transferrin?
   a) iron transport
   b) binding of copper ions
   c) hormone transport
   d) hemoglobin transports

437. Which parameters of blood will be increased at diseases knocking the connective tissue (rheumatic disease, systemic lesions of skin, tuberculosis)?
   a) sialine acids
   b) fucose
   c) aminosugars
   d) uroglycoproteins
438. What makes the prosthetic part of hemoglobin?
   a) protoporphyrin
   b) coproporphyrin
   c) uroporphyrin
   d) porphin
   e) casein

439. The molecular defect in hemoglobin S is
   a) valine substitutes glutamic acid
   b) glutamic acid substitutes valine
   c) α-chains substitutes β-chains
   d) β-chains substitutes α-chains

440. What is the volume ratio of plasma and forming elements of blood?
   a) plasma - 55-60 %, forming elements - 40-45 %
   b) plasma - 40-45 %, forming elements - 55-60 %
   c) plasma - 45-50 %, forming elements - 50-55 %
   d) plasma - 50-55 %, forming elements - 45-50 %
   e) plasma - 60-65 %, forming elements - 35-40 %

441. What is the total of blood in organism of adult person in norm related to the mass of the body?
   a) 6-8 %
   b) 2-4 %
   c) 10-12 %
   d) 14-16 %

442. Choose the buffer system, which is 2/3 of the buffering capacities of blood:
   a) hemoglobin
   b) plasma proteins
   c) bicarbonate
   d) phosphate

443. What is the content of globulins in the dry sediment of blood plasma?
   a) 2-3 %
   b) 4.5 %
   c) 0.2-0.4 %

444. Oncotic pressure of blood is due to:
   a) albumins
   b) globulins
   c) fibrinogen

445. Erythrocytes:
   a) are degraded in spleen and liver
   b) have 5 days lifetime
   c) are nucleus containing cells
446. Normal hemoglobin concentration in adult person:
   a) men - 145 g/l, women - 130 g/l
   b) men - 130 g/l, women - 145 g/l
   c) men - 120 g/l, women - 100 g/l

447. The physiological type of hemoglobin:
   a) fetal
   b) methemoglobin
   c) oxyhemoglobin
   d) carboxyhemoglobin

448. The hemoglobin-gase compound:
   a) carboxyhemoglobin
   b) methemoglobin
   c) primitive hemoglobin
   d) fetal hemoglobin
   e) hemoglobin of adults

449. Methemoglobin is...
   a) the hemoglobin oxidized by the strong oxidants
   b) hemoglobin with oxygen
   c) mutated hemoglobin
   d) hemoglobin with carbon monoxide
   e) hemoglobin with carbon dioxide

450. The hemoglobin is synthesized:
   a) by the erythroblasts of the bone marrow
   b) in the liver
   c) in the spleen
   d) in the lymph nodes

451. The minimum limit of osmotic resistance of erythrocytes corresponds to:
   a) the concentration of the common salt when there is a hemolysis of weak erythrocytes
   b) the concentration of the common salt when there is a hemolysis of all erythrocytes
   c) the concentration of the common salt when there is no hemolysis

452. The chemical hemolysis follows:
   a) the influence of the substances blasting protein-lipid environment of erythrocytes
   b) the transfusion of the incompatible blood group
   c) freezing and thawing of blood
   d) strong shaking of the blood

453. The mechanical hemolysis follows:
   a) the strong shaking of the blood
   b) the influence of the substances blasting protein-lipid environment of erythrocytes
   c) the transfusion of the incompatible blood group
   d) freezing and thawing of blood
454. The thermal hemolysis follows:
   a) freezing and thawing of blood
   b) the strong shaking of the blood
   c) the influence of the substances blasting protein-lipid environment of erythrocytes
   d) the transfusion of the incompatible blood group

455. The biological hemolysis follows:
   a) the transfusion of the incompatible blood group
   b) freezing and thawing of blood
   c) the strong shaking of the blood
   d) the influence of the substances blasting protein-lipid environment of erythrocytes

456. What is the oxyhemoglobin without oxygen?
   a) deoxyhemoglobin
   b) methemoglobin
   c) carboxyhemoglobin
   d) myoglobin
   e) carbhemoglobin

457. The pathological type of hemoglobin:
   a) glycosylated hemoglobin
   b) carbhemoglobin
   c) deoxyhemoglobin
   d) myoglobin

458. Na\(^+\) concentration in blood serum, mmol/l:
   a) 136-145
   b) 3.5-5.0
   c) 2.1-2.6
   d) 0.6-1.0

459. K\(^+\) concentration in blood serum, mmol/l:
   a) 3.5-5.0
   b) 136-145
   c) 2.1-2.6
   d) 0.6-1.0

460. Ca\(^{2+}\) concentration in blood serum, mmol/l:
   a) 2.1-2.6
   b) 136-145
   c) 3.5-5.0
   d) 0.6-1.0

461. Mg\(^{2+}\) concentration in blood serum, mmol/l:
   a) 0.6-1.0
   b) 136-145
   c) 3.5-5.0
d) 2.1-2.6

462. \( \text{HCO}_3^- \) concentration in blood serum, mmol/l:
   a) 24-28
   b) 100-110
   c) 1.1-1.5
   d) 0.3-0.6

463. \( \text{Cl}^- \) concentration in blood serum, mmol/l:
   a) 100-110
   b) 24-28
   c) 1.1-1.5
   d) 0.3-0.6

464. \( \text{HPO}_4^{2-} \) concentration in blood serum, mmol/l:
   a) 1.1-1.5
   b) 24-28
   c) 100-110
   d) 0.3-0.6

465. \( \text{SO}_4^{2-} \) concentration in blood serum, mmol/l:
   a) 0.3-0.6
   b) 24-28
   c) 100-110
   d) 1.1-1.5

466. Buffering capacity of protein buffer in plasma is:
   a) 24%
   b) 75%
   c) 10%
   d) 1%
   e) 0.5%

467. Buffering capacity of bicarbonate buffer in plasma is:
   a) 75%
   b) 24%
   c) 10%
   d) 1%
   e) 0.5%

468. Buffering capacity of phosphate buffer in plasma is:
   a) 1%
   b) 75%
   c) 24%
   d) 10%
   e) 0.5%
Reaction(s) catalyzed by delta-aminolevulinic acid synthase:

a) Succinyl-CoA + glycine $\rightarrow$ delta-Aminolevulinic acid
b) delta-Aminolevulinic acid $\rightarrow$ porphobilinogen
c) Porphobilinogen $\rightarrow$ hydroxymethylbilane
d) Hydroxymethylbilane $\rightarrow$ uroporphyrinogen III
e) Uroporphyrinogen III $\rightarrow$ coproporphyrinogen III
f) Coproporphyrinogen III $\rightarrow$ protoporphyrinogen IX
g) Protoporphyrinogen IX $\rightarrow$ protoporphyrin IX
h) Protoporphyrin IX $\rightarrow$ heme

Reaction(s) catalyzed by uroporphyrinogen decarboxylase:

a) Uroporphyrinogen III $\rightarrow$ coproporphyrinogen III
b) Succinyl-CoA + glycine $\rightarrow$ delta-Aminolevulinic acid
c) delta-Aminolevulinic acid $\rightarrow$ porphobilinogen
d) Porphobilinogen $\rightarrow$ hydroxymethylbilane
e) Hydroxymethylbilane $\rightarrow$ uroporphyrinogen III
f) Coproporphyrinogen III $\rightarrow$ protoporphyrinogen IX
g) Protoporphyrinogen IX $\rightarrow$ protoporphyrin IX
h) Protoporphyrin IX $\rightarrow$ heme

Reaction(s) catalyzed by ferrochelatase:

a) Protoporphyrin IX $\rightarrow$ heme
b) Succinyl-CoA + glycine $\rightarrow$ delta-Aminolevulinic acid
c) delta-Aminolevulinic acid $\rightarrow$ porphobilinogen
d) Porphobilinogen $\rightarrow$ hydroxymethylbilane
e) Hydroxymethylbilane $\rightarrow$ uroporphyrinogen III
f) Coproporphyrinogen III $\rightarrow$ protoporphyrinogen IX
g) Protoporphyrinogen IX $\rightarrow$ protoporphyrin IX
h) Protoporphyrin IX $\rightarrow$ heme

Which steps of heme catabolism occurs in blood:

a) Bilirubin $\rightarrow$ bilirubin-albumin
b) Hemoglobin $\rightarrow$ heme
c) Heme $\rightarrow$ verdoglobin
d) Verdoglobin $\rightarrow$ biliverdin
e) Biliverdin $\rightarrow$ bilirubin
f) Bilirubin $\rightarrow$ bilirubin diglucuronide
g) Bilirubin diglucuronide $\rightarrow$ bile

Which step of heme catabolism occurs in liver:

a) Bilirubin $\rightarrow$ bilirubin diglucuronide
b) Hemoglobin $\rightarrow$ heme
c) Heme $\rightarrow$ verdoglobin
d) Verdoglobin $\rightarrow$ biliverdin
e) Biliverdin $\rightarrow$ bilirubin
f) Bilirubin $\rightarrow$ bilirubin-albumin

Normal process for H$^+$ in kidney is:

a) Secretion
475. Normal process for uric acid in kidney is:
   a) Secretion
   b) Ultrafiltration
   c) Resorption

476. Normal process for creatinine in kidney is:
   a) Secretion
   b) Ultrafiltration
   c) Resorption

477. Normal process for lactate in kidney is:
   a) Resorption
   b) Ultrafiltration
   c) Secretion

478. Normal process for glucose in kidney is:
   a) Resorption
   b) Ultrafiltration
   c) Secretion

479. Normal process for amino acids in kidney is:
   a) Resorption
   b) Ultrafiltration
   c) Secretion

480. Normal process for 2-oxoacids in kidney is:
   a) Resorption
   b) Ultrafiltration
   c) Secretion

481. Normal process for the solute plasma components smaller than 15 kDa in kidney is:
   a) Ultrafiltration
   b) Resorption
   c) Secretion

482. Ca^{2+} resorption in kidney is inhibited by:
   a) Calcitonin
   b) Parathyrin
   c) Calcitriol
   d) Ca2+ ATPase
   e) Vasopressin
   f) Aldosterone
   g) Na+/K+ ATPase
483. Water resorption in kidney is stimulated by:
   a) Vasopressin
   b) Calcitonin
   c) Parathyrin
   d) Calcitriol
   e) Ca²⁺ ATPase
   f) Aldosterone
   g) Na⁺/K⁺ ATPase

484. K⁺-Na⁺-2Cl⁻ cotransporter in kidney is stimulated by:
   a) Aldosterone
   b) Calcitonin
   c) Parathyrin
   d) Calcitriol
   e) Ca²⁺ ATPase
   f) Vasopressin
   g) Na⁺/K⁺ ATPase

485. Neurons need energy for:
   a) Electrogenesis
   b) Gluconeogenesis
   c) Synthesis of creatine
   d) Synthesis of phospholipids

486. Neurotransmitters with the ionotropic action:
   a) Acetylcholine
   b) Norepinephrine
   c) Dopamine
   d) Opioids

487. Neurotransmitters with the metabotropic action:
   a) Opioids
   b) GABA
   c) Glycine