PART 1. ENZYMOLOGY AND BIOLOGICAL OXIDATION

1. ***CH_3-CH(OH)-CH_2-COOH → CH_3-CO-CH_2-COOH. The conversion of β-hydroxybutyrate to acetoacetate occurs by what type of reaction?***

a) reduction;
b) transfer;
c) oxidation;
d) dehydration;
e) hydroxylation.

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;
e) aminobutyrate.

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;
e) all of these.

9. ***Which amino acid is produced from two amino acids by an oxidation reaction?***

a) $HOOC-CH_2-CH_2-CH(NH_2)-COOH$;
b) $COOH-CH(NH_2)-CH_2-C_6H_5$;
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 amino acid contains an aromatic side chain?***

a) $HOOC-CH_2-CH_2-CH(NH_2)-COOH$;
b) $COOH-CH(NH_2)-CH_2-C_6H_5$;
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 amino acid contains a side chain that participates in electrostatic interactions?***

a) $HOOC-CH_2-CH_2-CH(NH_2)-COOH$;
b) $COOH-CH(NH_2)-CH_2-C_6H_5$;
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 amino acid migrates toward the anode in an electric field?***

a) $HOOC-CH_2-CH_2-CH(NH_2)-COOH$;
b) $COOH-CH(NH_2)-CH_2-C_6H_5$;
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;

d) insulin;
e) albumin.

17. ***This protein is composed of two polypeptide chains joined by disulfide bonds:***

a) hemoglobin;
b) myoglobin;
c) collagen;
d) insulin;
e) albumin.

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;
e) increase, then decrease.

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 CoA-SH;
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 CO_2 and H_2O EXCEPT:***

a) pantothenate;
b) niacin;
c) thiamine;
d) biotin;
e) riboflavin.

22. ***Compound A: HOOC-CH(OH)-CH(COOH)-CH_2-COOH;***
Compound B: HOOC-CH=CH-COOH
The segment of the TCA cycle where Compound A is converted to Compound B:

a) yields 5 moles of high-energy phosphate bonds per mole of Compound 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 CO_2 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;
e) the oxygen consumption will increase.

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;
e) ATP level will increase.

29. ***This vitamin is required for NAD^+ synthesis.***

a) riboflavin;
b) pantothenic acid;
c) niacin;
d) vitamin B_6;
e) biotin.

30. ***This vitamin is required for FAD synthesis.***

a) riboflavin;
b) pantothenic acid;
c) niacin;
d) vitamin B_6;

e) vitamin A.

31. ***This vitamin is required for Coenzyme A synthesis:***

a) riboflavin;
b) pantothenic acid;
c) niacin;
d) vitamin A;
e) vitamin B_6.

32. ***This vitamin is required for FMN synthesis:***

a) riboflavin;
b) pantothenic acid;
c) niacin;
d) vitamin A;
e) vitamin B_6.

33. ***This vitamin is required for pyridoxal phosphate synthesis.***

a) riboflavin;
b) pantothenic acid;
c) niacin;
d) vitamin B_6;
e) vitamin E.

34. ***The appropriate vitamin for blood clotting is:***

a) vitamin A;
b) vitamin C;
c) vitamin D;
d) vitamin K;
e) vitamin E.

35. ***The appropriate vitamin for calcium metabolism is:***

a) vitamin A;
b) vitamin C;
c) vitamin D;
d) vitamin K;
e) vitamin B_6.

36. ***The appropriate vitamin for collagen synthesis is:***

a) vitamin A;
b) vitamin C;
c) vitamin D;
d) vitamin K;
e) vitamin H.

37. ***The appropriate vitamin for vision is:***

a) vitamin A;
b) vitamin C;
c) vitamin D;
d) vitamin K;
e) vitamin E.

38. ***An intermediate(s) in the conversion of citrate to succinyl CoA in the TCA cycle:***

a) malate;

b) α-ketoglutarate;
c) citrate;
d) succinate;
e) all of these.

39. ***Converted to isocitrate by the enzyme aconitase:***

a) malate;
b) α-ketoglutarate;
c) citrate;
d) succinate;
e) all of these.

40. ***Formed by the addition of water across the double bond of fumarate:***

a) malate;
b) α-ketoglutarate;
c) citrate;
d) succinate;
e) all of these.

41. ***Oxidized to oxaloacetate by proper dehydrogenase:***

a) malate;
b) α-ketoglutarate;
c) citrate;
d) succinate;
e) all of these.

42. ***Generated in a reaction that produces GTP:***

a) malate;
b) α-ketoglutarate;
c) citrate;
d) succinate;
e) all of these.

43. ***The vitamin or vitamins required for activity of pyruvate dehydrogenase complex:***

a) thiamine;
b) niacin;
c) riboflavin;
d) both riboflavin and niacin;
e) all of these.

44. ***The vitamin or vitamins required for activity of malate dehydrogenase:***

a) thiamine;
b) niacin;
c) pyridoxine;
d) thiamine and niacin;
e) thiamine and pyridoxine.

45. ***The vitamin or vitamins required for activity of pyruvate carboxylase:***

a) thiamine;

b) niacin;
c) retinol;
d) thiamine and niacin;
e) thiamine, retinol, and 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;
e) all of these.

47. ***The vitamin or vitamins required for activity of succinate dehydrogenase:***

a) thiamine;
b) niacin;
c) thiamine and niacin;
d) neither thiamine nor niacin;
e) all of these.

48. ***Regulated allosterically by ADP:***

a) isocitrate dehydrogenase;
b) malate dehydrogenase;
c) both isocitrate and malate dehydrogenase;
d) neither dehydrogenase;
e) all of these.

49. ***Liberates CO_2:***

a) isocitrate dehydrogenase;
b) malate dehydrogenase;
c) both isocitrate and malate dehydrogenase;
d) neither dehydrogenase;
e) all of these.

50. ***Reduces a cofactor that transfers electrons to the electron transport chain:***

a) isocitrate dehydrogenase;
b) malate dehydrogenase;
c) fumarate hydratase;
d) both isocitrate and malate dehydrogenase;
e) neither enzyme.

51. ***Utilizes FAD as a cofactor:***

a) isocitrate dehydrogenase;
b) malate dehydrogenase;
c) both isocitrate and malate dehydrogenase;
d) neither dehydrogenase;
e) all of these.

52. ***Which electron-transporting chain components transports only electrons?***

a) cytochrome b;

b) NAD;
c) FMN;
d) ubiquinone;
e) all of these.

53. ***Which substance contains high-energy phosphate?***

a) adenosine monophosphate;
b) creatine phosphate;
c) FAD;
d) NADP;
e) all of these.

54. ***Fe^{2+} and Cu^{+} atoms are in the active center of...***

a) cytochrome c;
b) NADH-dehydrogenase;
c) ubiquinol dehydrogenase;
d) succinate dehydrogenase;
e) cytochrome oxydase.

55. ***Able to transport both electrons and protons:***

a) ubiquinone;
b) cytochrome oxydase;
c) cytochrome c;
d) cytochrome b;
e) all of these.

56. ***In respiratory chain between ubiquinone and cytochrome c1 there is a…***

a) cytochrome c;
b) cytochrome b5;
c) cytochrome b;
d) cytochrome a;
e) cytochrome a3.

57. ***Reducing of FAD(FMN) is characterized with proton bonding to:***

a) carbon atoms;
b) nitrogen atoms;
c) oxygen atoms;
d) phosphorus atoms;
e) all of these.

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;
e) all of these.

59. ***Terminal oxygen acceptor in ETC there is:***

a) hydrogen;

b) ubiquinone;
c) NAD;
d) oxygen;
e) cytochrome oxidase.

60. ***Electron donor in ETC there is:***

a) hydrogen;
b) oxygen;
c) sulfur;
d) iron;
e) copper.

61. ***Oxidative decarboxylation of pyruvate yields:***

a) citrate;
b) acetyl-CoA;
c) succinyl-CoA;
d) lactate;
e) all of these.

62. ***High-energy substrate is:***

a) acetyl-CoA;
b) citrate;
c) succinate;
d) lactate;
e) all of these.

63. ***Compound which is not TCA metabolite:***

a) acetyl-CoA;
b) citrate;
c) succinyl-CoA;
d) lactate;
e) all of these.

64. ***The product of α-ketoglutarate dehydrogenase complex:***

a) acetyl-CoA;
b) citrate;
c) succinyl-CoA;
d) lactate;
e) all of these.

65. ***Hydration reaction in TCA:***

a) fumarate → malate;
b) citrate → cis-aconitate;
c) malate → oxaloacetate;
d) isocitrate → α-ketoglutarate;
e) all of these.

66. ***Dehydrogenase reaction in TCA:***

a) fumarate → malate;

b) cis-aconitate → isocitrate;
c) citrate → cis-aconitate;
d) isocitrate → α-ketoglutarate;
e) all of these.

67. ***Lyase reaction in TCA:***

a) cis-aconitate → isocitrate;
b) malate → oxaloacetate;
c) isocitrate → α-ketoglutarate;
d) succinyl-CoA → succinate;
e) all of these.

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.

69. ***Localized in the intermembrane space of mitochondria:***

a) cytochrome a;
b) cytochrome a3;
c) cytochrome b;
d) cytochrome c1;
e) cytochrome c.

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.

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.

75. ***Catalase activity in blood is decreased in:***

a) hepatitis;
b) pancreatitis;
c) parotitis;
d) heart attack;
e) tuberculosis.

76. ***Uncouples oxidative phosphorylation:***

a) amobarbital;
b) antimycin;
c) cyanide;
d) dinitrophenol;
e) atractiloside.

77. ***P/O for NADH is:***

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_2O:***

a) 0;

b) 1;
c) 2;
d) 3;
e) 4.

81. ***Blocks ETC complex I:***

a) amobarbital;
b) carboxin;
c) antimycin;
d) cyanide;
e) atractiloside.

82. ***Blocks ETC complex II:***

a) amobarbital;
b) carboxin;
c) dinitrophenol;
d) oligomycin;
e) atractiloside.

83. ***Inhibits ETC complex III:***

a) carboxin;
b) antimycin;
c) cyanide;
d) dinitrophenol;
e) atractiloside.

84. ***Blocks ETC complex IV:***

a) amobarbital;
b) antimycin;
c) cyanide;
d) dinitrophenol;
e) atractiloside.

85. ***Inhibits H^+-ATP-ase:***

a) carboxin;
b) antimycin;
c) dinitrophenol;
d) oligomycin;
e) atractiloside.

86. ***Inhibits ATP/ADP-antiporter:***

a) amobarbital;
b) carboxin;
c) antimycin;
d) oligomycin;
e) atractiloside.

87. ***Uses oxygen as hydrogen acceptor:***

a) oxidase;

b) dehydrogenase;
c) hydroperoxidase;
d) monooxygenase;
e) dioxygenase.

88. ***Transfers H_2 from one substrate to another in redox-reactions:***

a) oxidase;
b) dehydrogenase;
c) hydroperoxidase;
d) monooxygenase;
e) dioxygenase.

89. ***Uses hydrogen peroxide or an organic peroxide as substrate:***

a) oxidase;
b) dehydrogenase;
c) hydroperoxidase;
d) monooxygenase;
e) dioxygenase.

90. ***Catalyzes the direct transfer and incorporation of oxygen into a substrate:***

a) oxidase;
b) dehydrogenase;
c) hydroperoxidase;
d) monooxygenase;
e) catalase.

91. ***Its activity in RBC is low in cancer and tuberculosis:***

a) oxidase;
b) dehydrogenase;
c) hydroperoxidase;
d) monooxygenase;
e) catalase.

PART 2. BIOCHEMISTRY OF CARBOHYDRATES

92. ***Chondroitin sulfates are built of:***

a) disaccharide including glucose and fructose;
b) disaccharide, including uronic acid and acetylhexoseamine;
c) hexosamine;
d) fructose;
e) all of these.

93. ***The hyaluronic acid consists of:***

a) glucuronic acid and N-acetylglucosamine;
b) glucose and a fructose;
c) glucuronic acid and N-acetylgalactosamine-6-sulfate;
d) gluconic acid and N-acetylglucosamine;
e) all of these.

94. ***Glucosamine proteoglycans are prosthetic part of:***

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;
e) all of these.

96. ***Dietary pectin is necessary for:***

a) building of cell walls;
b) energy sources;
c) prevent absorption of nutrients;
d) binding of heavy metals, toxins etc.;
e) all of these.

97. ***Choose the high-energy phosphates containing substance:***

a) 1,3-diphosphoglycerate;
b) 3-phosphoglycerate;
c) pyruvate;
d) adenosine monophosphate;
e) all of these.

98. ***What stage of energy substrates formation scheme has the greatest ATP output?***

a) 1^{st};
b) 2^{nd};
c) 3^{rd};
d) 4^{th};
e) all of these.

99. ***Oxidative decarboxylation of pyruvate produces:***

a) acetyl CoA;
b) citrate;
c) succinyl-CoA;
d) lactate;
e) all of these.

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;
e) all of these.

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;
e) all of these.

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;
d) 3 enzymes and 3 coenzymes;
e) 3 enzymes and 2 coenzymes.

103. ***Enzyme of substrate phosphorylation in TCA:***

a) isocitrate dehydrogenase;
b) succinyl-CoA-synthetase;
c) succinate dehydrogenase;
d) fumarase;
e) aconitase.

104. ***What substances entering with nutrition are the precursors of pyruvate?***

a) carbohydrates;
b) fatty acids;
c) cholesterol;
d) cellulose;
e) all of these.

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;
e) all of these.

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;
e) all of these.

107. ***Oxidation reaction is:***

a) oxaloacetate → citrate;
b) citrate → isocitrate;
c) malate → oxaloacetateж
d) fumarate → malateж
e) all of these.

108. ***The velocity of TCA reactions is decreased during the rest due to accumulation of:***

a) ATP;
b) lactate;
c) pyruvate;
d) $FADH_2$;
e) all of these.

109. ***This conversions occurs at the 2nd stage of energy substrates formation:***

a) proteins → amino acids;
b) acetyl-CoA → $H_2O + CO_2$;
c) fat → glycerol + fatty acids;
d) amino acids → pyruvate;
e) all of these.

110. ***In what reactions of TCA decarboxylation occurs?***

a) oxaloacetate → citrate;
b) α-ketoglutarate → succinyl-CoA;
c) fumarate→ malate;
d) malate → oxaloacetate;
e) all of these.

111. ***How many molecules of $NADH+H^+$ can be formed per one TCA turn?***

a) 1;
b) 2;
c) 3;
d) 4;
e) 5.

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;
e) TPP, NAD, FAD, lipoamide, HSCoA.

113. ***At the third stage of unification of energy substrates there is a transformation:***

a) polysaccharides → monosaccharides;
b) acetyl-CoA → $H_2O + CO_2$;
c) fatty acids → ketone bodies;
d) glycerol → pyruvate;
e) glucose → glucose-6-phosphate.

114. ***The transformation of succinate to malate in TCA reactions occurs through:***

a) citrate;
b) fumarate;
c) oxaloacetate;
d) succinyl-CoA;
e) acetyl-CoA.

115. ***How many molecules $FADH_2$ are formed during TCA?***

a) 0;
b) 1;
c) 2;
d) 3;
e) 4.

116. ***During reactions of unification of energy substrates one common metabolite is formed:***

a) pyruvate;
b) citrate;
c) acetyl-CoA;
d) succinyl-CoA;
e) succinate.

117. ***Choose the metabolites of tricarboxylic acid cycle:***

a) pyruvate, lactate;
b) glucose, glycerol;
c) aspartate, glutamate;
d) isocitrate, ATP;
e) oxaloacetate, succinate.

118. ***What reactions in TCA are catalyzed by NAD-dependent enzymes?***

a) isocitrate → α-ketoglutarate;
b) succinate → fumarate;
c) oxaloacetate → citrate;
d) fumarate → malate;
e) citrate → isocitrate.

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) 3 ATP;
b) 9 ATP;
c) 12 ATP;
d) 15 ATP;
e) 18 ATP.

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

a) decarboxylation;
b) dehydrogenations;
c) transfer of acetyl group;
d) hydration;
e) isomerization.

122. ***The coenzyme form of vitamin B_1 is:***

a) pyridoxal phosphate;
b) flavin adenine mononucleotide;
c) nicotinamide adenine dinucleotide phosphate;
d) thiamine pyrophosphate;
e) retinal.

123. ***The coenzyme form of vitamin H is:***

a) pyridoxal phosphate;
b) methylcobalamine;
c) retinal;
d) thiamine pyrophosphate;
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;
e) carboxylation of pyruvate.

125. ***Biochemical functions of TPP (thiamine pyrophosphate):***

a) hydrogen transfer;
b) transamination and decarboxylation of amino acids;
c) decarboxylation of α-ketoacids;
d) transport of acyl groups;
e) oxidation of lipoamide.

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 centigrade 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) B_9;
b) B_{12};
c) C;
d) B_6;
e) 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:***
CH_3-CH(NH_2)-COOH + HOOC-CH_2-CH_2-CO-COOH → CH_3-CO-COOH + HOOC-CH_2-CH_2-CH(NH_2)-COOH

a) oxidoreductases;
b) transferases;
c) hydrolases;
d) lyases;
e) isomerases.

135. ***What role play the disulfide bonds in enzyme molecule:***

a) stabilize the secondary structure;
b) participate in multimerization of the proteins;
c) stabilize the tertiary structure;

d) stabilize the quaternary structure;
e) substrate binding.

136. ***In what part of enzyme the metals are more often?***

a) prosthetic group;
b) substrate-binding site;
c) allosteric site;
d) catalytic site;
e) inhibitor binding site.

137. ***To which class belongs the enzyme catalyzing the reaction:***
$HOOC\text{-}CHOH\text{-}CH_2\text{-}COOH \rightarrow HOOC\text{-}CH{=}CH\text{-}COOH + H_2O$

a) oxidoreductases;
b) hydrolases;
c) lyases;
d) ligases;
e) isomerases.

138. ***To which class belongs the enzyme catalyzing the reaction:***
$HOOC\text{-}CH_2\text{-}CH_2\text{-}CH(NH_2)\text{-}COOH \rightarrow HOOC\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}NH_2 + CO_2$

a) oxidoreductases;
b) hydrolases;
c) lyases;
d) ligases;
e) transferases.

139. ***Which enzyme catalyzes the reaction:***
$CH_3\text{-}CO\text{-}COOH + NADH_2 \rightarrow CH_3\text{-}CHOH\text{-}COOH + NAD^+$

a) lactate dehydrogenase;
b) pyruvate dehydrogenase;
c) succinate dehydrogenase;
d) malate dehydrogenase;
e) alanine aminotransferase.

140. ***Which enzyme catalyzes the reaction:***
$CH_3\text{-}CHOH\text{-}COOH + NAD^+ \rightarrow CH_3\text{-}CO\text{-}COOH + NADH_2$

a) lactate dehydrogenase;
b) pyruvate dehydrogenase;
c) succinate dehydrogenase;
d) malate dehydrogenase;
e) aspartate aminotransferase.

141. ***Which is the competitive inhibitor of succinate dehydrogenase?***

a) $COOH\text{-}CH_2\text{-}COOH$;
b) $COOH\text{-}CH_2\text{-}CH_2\text{-}COOH$;
c) $COOH\text{-}CO\text{-}CH_3$;
d) $COOH\text{-}CH_2\text{-}COH$;
e) $COOH\text{-}CH_2\text{-}CH_3$.

142. ***(1) In sugar diabetes the high density urine is secreted SINCE (2) 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) bilirubin.

144. ***What substances are determined in the urine in starving state?***

a) protein;
b) hemoglobin;
c) glucose;
d) ketone bodies;
e) creatine.

145. ***What enzyme in glycolysis is inducible, allosterically modified, and crucial for breaking down of glucose?***

a) phosphofructokinase;
b) aldolase;
c) hexokinase;
d) phosphorylase;
e) lactate dehydrogenase.

146. ***A high ATP/AMP ratio will inhibit which of the following enzyme?***

a) glyceraldehyde-3-P dehydrogenase;
b) pyruvate kinase;
c) enolase;
d) phosphofructokinase;
e) glucose-6-P dehydrogenase
f) .

147. ***Through which metabolite the pyruvate will be converted to glucose?***

a) COOH-CO-CH_2-COOH;
b) COOH-CHOH-CH_2-COOH;
c) COOH-CHOH-CH_3;
d) CH_3-CO-S-CoA;
e) CH_3-CO-CH_3.

148. ***What TCA metabolite oxidation is impaired at the drop of NAD^+/NADH ratio in sugar diabetes?***

a) COOH-CO-CH_2-COOH;
b) COOH-CHOH-CH_3;
c) CH_3-CO-CH_3;
d) COOH-CHOH-CH_2-COOH;
e) COOH-CH_2-CH_2-COOH.

149. ***What is the mechanism of intracellular regulation of metabolism by regulatory molecules?***

a) regulation by hormones;
b) regulation by substrate availability;
c) regulation of enzymes activity by releasing-factors;
d) isosteric regulation;
e) allosteric regulation.

150. ***Key metabolite, which is poor utilized in TCA in sugar diabetes due to low activity of citrate synthase:***

a) CH_3-CO-S-CoA;
b) COOH-CO-CH_2-COOH;
c) COOH-CHOH-CH_3;
d) COOH-CH_2-CH_2-COOH;
e) COOH-CH_2-CH_2-CO-S-CoA.

151. ***(1) The insulin decreases glucose blood level BECAUSE (2) 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.

152. ***The activity of which enzyme is impaired in low $NAD^+/NADH+H^+$ ratio?***

a) citrate synthase;
b) isocitrate dehydrogenase;
c) succinate dehydrogenase;
d) aldolase;
e) glucose-6-phosphate dehydrogenase.

153. ***The activity of glucose-6-phosphate dehydrogenase in increased $NADP^+/NADPH+H^+$ ratio…***

a) will be increased;
b) will be decreased;
c) will be stabilized;
d) will not be changed;
e) there is no correct answer.

154. ***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.

155. ***Vitamin PP deficiency can result in drop of enzyme activity:***

a) citrate synthase;
b) glucose-6-phosphatase;
c) fructose-1,6-bisphosphatase;
d) malate dehydrogenase;
e) glycogen phosphorylase.

156. ***(1) Increased glucagon level promotes development of sugar diabetes BECAUSE (2) the glucagon is developed in the δ-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 incorrect, the second - is incorrect, there is a causal nexus;
e) the first part of the statement is true, the second - is incorrect, there is no causal nexus.

157. ***Pentose phosphate pathway blocking in sugar diabetes results in:***

a) increase of acetyl-CoA;
b) decrease of glucose-6-phosphate;
c) predominance of ketone bodies synthesis;
d) inhibition of citrate synthase;
e) inhibition of hexokinase.

158. ***The conversion of 3-phosphoglycerate to the fatty acids is carried out through…***

a) acetoacetate;
b) β-hydroxybutyrate;
c) acetyl-CoA;
d) glycerol phosphate;
e) oxaloacetate.

159. ***The activity of blood α-amylase is increased in liver diseases BECAUSE the liver plays the 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.

160. ***Liver is the unique organ delivering glucose for the 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;
e) the first part of the statement is incorrect, the second - is incorrect, there is no causal nexus.

161. ***Somatotropin is … hormone:***

a) anabolic;
b) catabolic;
c) antidiabetogenic;
d) lipogenic;
e) none of the variants.

162. ***Adrenalin is … hormone:***

a) anabolic;
b) catabolic;
c) antidiabetogenic;
d) lipogenic;
e) none of the variants.

163. ***Which enzyme activates specific phosphorylase kinase?***

a) adenylate cyclase;
b) guanylate cyclase;
c) protein kinase;
d) phosphodiesterase;
e) phosphorylase.

164. ***Which enzyme catalyzes the formation of cAMP?***

a) adenylate cyclase;

b) guanylate cyclase;
c) protein kinase;
d) phosphorylase kinase;
e) phosphorylase.

165. ***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.

166. ***Which hormone activates the synthesis of proteins, lipids and carbohydrates?***

a) insulin;
b) prolactin;
c) somatotropin;
d) luteinizing hormone;
e) thymosin.

167. ***Which hormone represents the 51 amino acid containing protein and consisting of 2 polypeptide chains?***

a) insulin;
b) glucagon;
c) adrenocorticotropin;
d) oxytocin;
e) aldosterone.

168. ***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) increasing glycogen synthesis;
e) no changes.

169. ***What substance is necessary in the reaction: Citrate + HSCoA → Oxaloacetate + ...***

a) acetyl-CoA;
b) β-ketoacyl-CoA;
c) acyl-CoA;
d) enoyl-CoA;
e) succinyl-CoA.

170. ***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.

171. ***Choose the correct statements:***

a) glucose is aldose;
b) fructose is aldose;
c) deoxyribose is a polysaccharide;
d) cellulose consists of the glucose residues linked by α-glycosidic bonds;
e) heparin is a homopolysaccharide.

172. ***Which from the listed nucleotides is the carrier of glucose residues in the biosynthesis of glycogen?***

a) NAD^+;
b) UTP;
c) UDP;
d) ADP;
e) GTP.

173. ***Which enzyme catalyzes the reaction:***
$(C_6H_{10}O_5)_n + P_i \rightarrow (C_6H_{10}O_5)_{n-1}$ +glucose-1-phosphate

a) amylase;
b) glycogen phosphorylase;
c) phosphoglucomutase;
d) glucose-6-phosphatase;
e) glycogen synthase.

174. ***Which enzyme catalyzes the reaction:***
glucose-6-phosphate ↔ glucose-1-phosphate

a) phosphohexose isomerase;
b) glucose-6-phosphatase;
c) hexokinase;
d) aldolase;
e) phosphoglucomutase.

175. ***Choose the true continuation: "In the muscles glucose-6-phosphate isn't converted to glucose because there is no enzyme... "***

a) glucose-6-phosphatase;
b) glucokinase;
c) hexokinase;
d) aldolase;
e) phosphoglucomutase.

176. ***Which enzyme catalyzes the reaction:***
glucose-6-phosphate ↔ fructose-6-phosphate

a) phosphoglucomutase;
b) phosphofructokinase;
c) phosphorylase;
d) phosphatase;
e) phosphohexose isomerase.

177. ***Which enzyme catalyzes the reaction:***
fructose-6-phosphate → glucose-6-phosphate

a) phosphoglucomutase;
b) phosphohexose isomerase;
c) phosphofructokinase;
d) fructose-1,6-bisphosphatase;
e) glucose-6-phosphatase.

178. ***Specify the enzyme which failure produces galactosemia:***

a) galactokinase;
b) UDP-galactose epimerase;

c) galactose-1-phosphate-uridyl transferase;
d) galactose-1-phosphatase;
e) hexokinase.

179. ***Which reaction is catalyzed by glycogen synthase?***

a) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-2}$ + maltose;
b) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose;
c) $(C_6H_{10}O_5)_n + H_2O \rightarrow$ dextrins $\rightarrow$ maltose;
d) $(C_6H_{10}O_5)_n$ + UDP-glucose $\rightarrow (C_6H_{10}O_5)_{n+1}$ + UDP;
e) $C_6H_{12}O_6 + ATP \rightarrow C_6H_{11}O_6\text{-}PO_3H_2 + ADP$.

180. ***Which reaction is catalyzed by hexokinase (glucokinase):***

a) $(C_6H_{10}O_5)_n$ + UDP-glucose $\rightarrow (C_6H_{10}O_5)_{n+1}$ + UDP;
b) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose;
c) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-2}$ + maltose;
d) $C_6H_{12}O_6 + ATP \rightarrow C_6H_{11}O_6\text{-}PO_3H_2 + ADP$;
e) $(C_6H_{10}O_5)_n + H_3PO_4 \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose-1-phosphate.

181. ***Which reaction is catalyzed by α-amylase?***

a) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose;
b) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-2}$ + maltose;
c) $(C_6H_{10}O_5)_n + H_2O \rightarrow$ dextrins $\rightarrow$ maltose;
d) $(C_6H_{10}O_5)_n$ + UDP-glucose $\rightarrow (C_6H_{10}O_5)_{n+1}$ + UDP;
e) $(C_6H_{10}O_5)_n + H_3PO_4 \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose-1-phosphate.

182. ***What reaction is catalyzed by glycogen phosphorylase?***

a) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose;
b) $(C_6H_{10}O_5)_n + H_2O \rightarrow (C_6H_{10}O_5)_{n-2}$ + maltose;
c) $(C_6H_{10}O_5)_n + H_2O \rightarrow$ dextrins $\rightarrow$ maltose;
d) $(C_6H_{10}O_5)_n$ + UDP-glucose $\rightarrow (C_6H_{10}O_5)_{n+1}$ + UDP;
e) $(C_6H_{10}O_5)_n + H_3PO_4 \rightarrow (C_6H_{10}O_5)_{n-1}$ + glucose-1-phosphate.

183. ***The glycogen is…:***

a) the unbranched polysaccharide consisting of glucose residues, linked by α-1,4- and α-1,6-glycosidic bond;
b) the linear polysaccharide consisting of glucose residues, linked by α-1,4-glycosidic bond;
c) heavy-branched polysaccharide consisting of glucose residues, linked by α-1,4- and α-1,6- glycosidic bond;
d) the linear polysaccharide consisting of glucose residues, linked by β-1,4-glycosidic bond;
e) the molecule, which synthesis can be increased by epinephrine.

184. ***Deficiency of whish enzyme results in von Gierke disease?***

a) muscular phosphorylase;
b) liver glucose-6-phosphatase;
c) amylo-1,6-glucosidase;
d) galactose-1-phosphate-uridyltransferase;
e) acidic α-glucosidase.

185. ***Deficiency of which enzyme results in aglycogenosis?***

a) glycogen synthase;
b) glucose-6-phosphatase;
c) muscular phosphorylase;
d) amylo-1,6-glucosidase;
e) acidic α-glucosidase.

186. ***Cori's (Forbs') disease is due to deficiency of the enzyme:***

a) glucose-6-phosphatase;
b) glycogen synthase;
c) amylo-1,6-glusosidase;
d) galactose-1-phosphate-uridyltransferase;
e) acidic α-glucosidase.

187. ***McArdle disease - deficiency of the enzyme:***

a) glucose-6-phosphatase;
b) amylo-1,6-glucosidase;
c) galactose-1-phosphate-uridyltransferase;
d) phosphorylase in muscles;
e) acidic α-glucosidase.

188. ***Which hormones cause hypoglycemia?***

a) insulin;
b) cortisol;
c) thyroxin;
d) glucagon;
e) testosterone;

189. ***How many ATP is formed after complete oxidation of 1 fructose-1,6-bisphosphate molecule?***

a) 15;
b) 24;
c) 34;
d) 37;
e) 38.

190. ***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.

191. ***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;
e) 3-phosphoglyceraldehyde → dihydroxy acetone phosphate.

192. ***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;
e) 3-phosphoglyceraldehyde → dihydroxy acetone phosphate.

193. ***Which reaction is catalyzed by transketolase?***

a) glucose-6-phosphate + $NADP^+$ → 6-phosphogluconate + HADPH + H^+;
b) 6-phosphogluconate + $NADP^+$ → ribulose-5-phosphate + HADPH + H^+ + CO_2;
c) fructose + ATP → fructose-1-phosphate + ADP;
d) 3-phosphoglyceraldehyde → dihydroxy acetone phosphate;
e) xylulose-5-phosphate + ribose-5-phosphate → 3-phosphoglyceraldehyde + sedoheptulose-7-phosphate.

194. ***Choose the reaction of substrate-level phosphorylation:***

a) 3-phosphoglycerate→ 2-phosphoglycerate;
b) glucose-6-phosphate + H_2O → glucose + H_3PO_4;
c) oxaloacetate + GTP → phosphoenolpyruvate + CO_2 + GDP;
d) 1,3-bisphosphoglycerate + ADP → 3-phosphoglycerate + ATP;
e) 6-phosphogluconate + $NADP^+$ → ribulose-5-phosphate + HADPH+H^+ + CO_2.

195. ***In which tissue the gluconeogenesis is most active?***

a) liver;
b) adipose tissue;
c) skeletal muscles;
d) brain;
e) erythrocytes.

196. ***In which tissue the pentose cycle is most active?***

a) skeletal muscles;
b) malignant tumor;
c) liver;
d) brain;
e) erythrocytes.

197. ***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.

198. ***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) fructose and galactose;
b) fructose and glucose;
c) galactose and glucose;
d) glucose, fructose, and galactose;
e) glucose only.

PART 3. BIOCHEMISTRY OF LIPIDS

199. ***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.

200. ***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.

201. ***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.

202. ***The transport form of exogenous triglycerides:***

a) chylomicrons;
b) VLDL;
c) HDL;
d) LDL;
e) albumins.

203. ***The transport form of endogenous triglycerides:***

a) chylomicrons;
b) VLDL;
c) HDL;
d) LDL;
e) albumins.

204. ***The transport form of cholesterol from liver to peripheric cells:***

a) LDL;
b) chylomicrons;
c) HDL;
d) albumins;
e) all of the above.

205. ***The transport form of cholesterol from peripheric cells to liver:***

a) chylomicrons;
b) VLDL;
c) LDL;
d) HDL;

e) albumins.

206. ***Free fatty acids are transported in blood with:***

a) chylomicrons;
b) VLDL;
c) HDL;
d) LDL;
e) albumins.

207. ***What is energy yield of acyl-CoA oxidation up to enoyl-CoA?***

a) 2 ATP;
b) 10 ATP;
c) 12 ATP;
d) 15 ATP;
e) 20 ATP.

208. ***What enzyme catabolizes VLDL?***

a) pancreatic lipase;
b) enteric lipase;
c) lipoprotein lipase;
d) triglyceride lipase;
e) phospholipases.

209. ***What substance is lacking in the scheme of reaction:***
Acetyl-CoA + CO_2 + ATP → ADP + P_i + …

a) acetyl-CoA;
b) acyl-CoA;
c) citrate;
d) butyryl-CoA;
e) malonyl-CoA.

210. ***What substance is lacking in the scheme of reaction***
acyl-CoA + FAD → … + $FADH_2$

a) acetyl-CoA;
b) butyryl-CoA;
c) enoyl-CoA;
d) malonyl-CoA;
e) β-hydroxyacyl-CoA.

211. ***What substance is lacking in the scheme of reaction***
β-hydroxyacyl-CoA + NAD^+ → … + NADH + H^+

a) acetyl-CoA;
b) acyl-CoA;
c) butyryl-CoA;
d) enoyl-CoA;
e) β-ketoacyl-CoA.

212. ***What substance is lacking in the scheme of reaction***
$R\text{-}CO\text{-}CH_2\text{-}CO\text{-}SCoA + CoASH \rightarrow R\text{-}CO\text{-}SCoA + \ldots$

a) acetyl-CoA;
b) acyl-CoA;
c) malonyl-CoA;
d) enoyl-CoA;
e) succinyl-CoA.

213. ***What substance is lacking in the scheme of reaction***
oxaloacetate + ... → citrate + HSCoA

a) acetyl-CoA;
b) β-ketoacyl-CoA;
c) malonyl-CoA;
d) butyryl-CoA;
e) enoyl-CoA.

214. ***The cholesterol is the precursor of:***

a) acetyl-CoA;
b) bile acids;
c) fatty acids;
d) reproduction vitamin;
e) prostaglandins.

215. ***Which are the atherogenic lipoproteins?***

a) chylomicrons;
b) foamy cells;
c) HDL;
d) LDL;
e) lipid micelles.

216. ***Antiatherogenic lipoproteins:***

a) chylomicrons;
b) HDL;
c) LDL;
d) VLDL;
e) lipid micelles.

217. ***Which lipoproteins are precursors of LDL?***

a) chylomicrons;
b) HDL;
c) lipid micelles;
d) none of these;
e) VLDL.

218. ***The main fatty acids catabolism pathway is:***

a) decarboxylation;
b) reduction;
c) α-oxidation;
d) β-oxidation;

e) ω-oxidation.

219. ***Which lipoprotein consists of protein - 2%, triglycerides - 85%, phosphatides - 7%, cholesterol - 2%, cholesteryl esters - 4%?***

a) chylomicrons;
b) LDL;
c) VLDL;
d) HDL;
e) IDL.

220. ***Which lipoprotein consists of protein - 10%, triglycerides - 50%, phosphatides - 18%, cholesterol - 7%, cholesteryl esters - 15%?***

a) chylomicrons;
b) IDL;
c) HDL;
d) LDL;
e) VLDL.

221. ***Which lipoprotein consists of protein - 25%, triglycerides - 7%, phosphatides - 21%, cholesterol - 7%, cholesteryl esters - 40%?***

a) chylomicrons;
b) HDL;
c) LDL;
d) VLDL;
e) lipid micelles.

222. ***Which lipoprotein consists of protein - 45%, triglycerides - 5%, phosphatides - 25%, cholesterol - 5%, cholesteryl esters - 20%?***

a) chylomicrons;
b) HDL;
c) LDL;
d) VLDL;
e) lipid micelles.

223. ***Which lipoprotein contains the enzyme LCAT?***

a) HDL;
b) VLDL;
c) LDL;
d) chylomicrons;
e) lipid micelles.

224. ***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;
d) CH_3-CH_2-CO-COOH;
e) HOOC-CH_2-CH_2-COOH.

225. ***Which enzyme catalyzes the reaction:***
CH_3-CO-SCOA + CH_3-CO-SCoA → CH_3-CO-CH_2-CO-SCoA + HSCoA?

a) thiokinase;
b) 3-ketothiolase;
c) acetyl-CoA-carboxylase;
d) hydroxy-methyl-glutaryl-CoA-reductase;
e) LCAT.

226. ***Which enzyme catalyzes the reaction:***
CH_3-CO-SCoA + HCO_3^- + ATP → COOH-CH_2-CO-SCoA + ADP + P_i?

a) hydroxy-methyl-glutaryl-CoA-reductase;
b) thiolase;
c) acetyl-CoA-carboxylase;
d) thiokinase;
e) LCAT.

227. ***Which enzyme catalyzes the reaction:***
β-OH, β-CH_3-glutaryl-CoA + 2 NADPH + H+ → mevalonate + 2 $NADP^+$

a) thiolase;
b) acetyl-CoA-carboxylase;
c) cholesterolesterase;
d) LCAT;
e) HMG-CoA-reductase.

228. ***Which enzyme catalyzes the reaction:***
R-OOH + ATP + HSCoA → R-CO-SCoA + AMP + PP_i?

a) LCAT;
b) acetyl-CoA-carboxylase;
c) acyl-CoA-synthetase;
d) β-hydroxy-β-methyl-glutaryl-CoA-reductase;
e) cholesterol esterase.

229. ***Which enzyme catalyzes the reaction:***
Cholesterol + R-CO-SCoA ↔ cholesterol ether + HS-CoA?

a) thiokinase;
b) thiolase;
c) LCAT;
d) ACAT;
e) β-hydroxy-β-methyl-glutaryl-CoA-reductase.

230. ***Which enzyme catalyzes the reaction:***
CH_3-CO-CH_2-COSCoA + CH_3-CO-SCoA → β-hydroxy-β-methyl-glutaryl-SCoA

a) thiokinase;
b) thiolase;
c) acetyl-CoA-carboxylase;
d) HMG-CoA-reductase;
e) HMG-CoA synthase.

231. ***Which enzyme catalyzes the reaction:***
Glycerol + ATP → α-glycerol phosphate + ADP

a) glycerol kinase;
b) glycerol-3-phosphate dehydrogenase;
c) glyceraldehydes-3-phosphate dehydrogenase;
d) phosphoglycerate kinase;
e) phosphoglyceromutase.

232. ***Which cytoplasmic enzyme catalyzes the reaction:***
Glycerol-3-phosphate + NAD^+ → DHAP + NADH + H^+

a) glyceraldehyde phosphate dehydrogenase;
b) phosphoglycerate kinase;
c) phosphoglycerate mutase;
d) glycerol kinase;
e) glycerol-3-phosphate dehydrogenase.

233. ***What is the energy yield of complete glycerol oxidation?***

a) 2 ATP;
b) 12 ATP;
c) 15 ATP;
d) 22 ATP;
e) 36 ATP.

234. ***Select the intermediate of ketone bodies synthesis:***

a) malonyl-CoA;
b) β-hydroxybutyrate;
c) β-hydroxy-β-methyl-glutaryl-CoA;
d) succinyl-CoA;
e) acetoacetate.

235. ***The biological role of ketone bodies is:***

a) activator of glycolysis;
b) structural component of the cell;
c) energy source;
d) cholesterol transport;
e) important buffer in the blood serum.

236. ***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.

237. ***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.

238. ***Which nitrogen compound takes part in acetyl-CoA carboxylation while synthesis of fatty acids?***

a) carnitine;
b) biotin;
c) creatine;
d) methionine;
e) choline.

239. ***Which substance prevents fatty liver?***

a) carnitine;
b) creatine;
c) carnosine;
d) biotin;
e) methionine.

240. ***The first reaction in glycerol metabolism:***

a) phosphorylation;
b) reduction;
c) oxidation;
d) acylation;
e) methylation.

Which high-energy bond containing 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) $NADPH+H^+$;
c) $FADH_2$;
d) $FMNH_2$;
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 lecithin;
e) transport of cholesterol.

246. ***Which enzyme catalyzes the reaction?***
$H_2N\text{-}CH_2\text{-}CH_2\text{-}OH + ATP \rightarrow H_2N\text{-}CH_2\text{-}CH_2\text{-}O\text{-}PO_3H_2 + ADP$

a) ethanolamine kinase;
b) choline kinase;
c) glycerol kinase;
d) serine kinase;
e) alanine aminotransferase.

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) phosphatidate;
e) 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) acetoacetyl-CoA, β-hydroxybutyrate, acetyl-CoA, β-hydroxy-β-methylglutaryl-CoA, acetoacetate;
c) acetyl-CoA, acetoacetate, β-hydroxy-β-methylglutaryl-CoA, acetoacetyl-CoA, β-hydroxybutyrate;
d) acetyl-CoA, acetoacetyl-CoA, β-hydroxybutyrate, acetoacetate, β-hydroxy-β-methylglutaryl-CoA;
e) acetyl-CoA, acetoacetyl-CoA, β-hydroxy-β-methylglutaryl-CoA, acetoacetate, β-hydroxybutyrate.

252. ***The substance shown is:***
$HOOC-CH_2-C(CH_3)(OH)-CH_2-CH_2OH$

a) acetoacetyl-CoA;
b) malonyl-CoA;
c) mevalonic acid;
d) β-hydroxyacyl-CoA;
e) β-hydroxy-β-methylglutaryl-CoA.

253. ***The substance shown is:***
$R-CH_2-CH=CH-CO-S-CoA$

a) acetoacetyl-CoA;
b) enoyl-CoA;
c) malonyl-CoA;
d) β-hydroxy-β-methylglutaryl-CoA;
e) β-ketoacyl-CoA.

254. ***The substance shown is:***
$R-CH_2-CHOH-CH_2-CO-S-CoA$

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:***
$R-CH_2-CO-CH_2-CO-S-CoA$

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:***
$HOOC-CH_2-CO-S-CoA$

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 + H_2O → diacylglycerol +H_3PO_4

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:***
Diacylglycerol phosphate + H_2O → Diacylglycerol +H_3PO_4

a) glycerol kinase;
b) LCAT;
c) lipoprotein lipase;
d) phosphatidate phosphatase;
e) phosphoenol carboxykinase.

259. ***Which metabolic pathway encounters the reaction:***
Diacylglycerol phosphate + CTP → CDP-diacylglycerol + $H_4P_2O_8$

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 glycerol phosphate mechanism.

261. ***Fill the gap in the equation:***
CDP-ethanolamine +... → Phosphatidyl ethanolamine + CMP

a) 1,2-diacylglycerol;
b) ethanolamine;
c) glycerol;
d) glycerol-3-phosphate;
e) serine.

262. ***Select the lipogenic (antilipolytic) hormone:***

a) adrenalin;
b) cortisol;
c) glucagon;
d) insulin;
e) thyroxin.

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) avidin;
b) citrate;
c) carnitine;
d) lactalbumin;
e) $NADH+H^+$.

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) HDL component;
b) LCAT activator;
c) marker of chylomicrons;
d) LCAT inhibitor;
e) marker of LDL.

272. ***ApoB-48 are markers of:***

a) chylomicrons;
b) VLDL;
c) LDL;
d) IDL;
e) HDL.

273. ***Which enzyme catalyzes VLDL catabolism?***

a) pancreatic lipase;
b) stomach lipase;
c) phospholipase;
d) lipoprotein lipase;
e) triglyceride lipase.

Answers

Enzymology and biological oxidation

1 c, 2 e, 3 b, 4 d, 5 b, 6 c, 7 b, 8 a, 9 c, 10 b, 11 a, 12 a, 13 c, 14 b, 15 a, 16 c, 17 d, 18 b, 19 d, 20 c, 21 d, 22 b, 23 d, 24 c, 25 b, 26 e, 27 c, 28 d, 29 c, 30 a, 31 b, 32 a, 33 d, 34 d, 35 c, 36 b, 37 a, 38 b, 39 c, 40 a, 41 a, 42 d, 43 e, 44 b, 45 e, 46 c, 47 d, 48 a, 49 a, 50 d, 51 d, 52 a, 53 b, 54 e, 55 a, 56 c, 57 b, 58 c, 59 d, 60 a, 61 b, 62 a, 63 d, 64 c, 65 a, 66 d, 67 a, 68 c, 69 e, 70 a, 71 e, 72 e, 73 b, 74 d, 75 e, 76 d, 77 d, 78 c, 79 b, 80 a, 81 a, 82 b, 83 b, 84 c, 85 d, 86 e, 87 a, 88 b, 89 c, 90 d, 91 e.

Biochemistry of Carbohydrates

92 b, 93 a, 94 e, 95 b, 96 d, 97 a, 98 c, 99 a, 100 a, 101 c, 102 b, 103 b, 104 a, 105 c, 106 b, 107 c, 108 a, 109 d, 110 b, 111 c, 112 c, 113 b, 114 b, 115 b, 116 c, 117 e, 118 a, 119 d, 120 d, 121 a, 122 d, 123 e, 124 c, 125 c, 126 d, 127 b, 128 a, 129 e, 130 e, 131 c, 132 e, 133 b, 134 b, 135 c, 136 a, 137 c, 138 c, 139 a, 140 a, 141 a, 142 a, 143 b, 144 d, 145 a, 146 d, 147 a, 148 d, 149 e, 150 a, 151 c, 152 b, 153 a, 154 d, 155 d, 156 e, 157 b, 158 c, 159 a, 160 a, 161 a, 162 b, 163 c, 164 a, 165 d, 166 a, 167 a, 168 b, 169 a, 170 b, 171 a, 172 c, 173 b, 174 e, 175 a, 176 e, 177 b, 178 c, 179 d, 180 d, 181 c, 182 e, 183 c, 184 b, 185 a, 186 c, 187 d, 188 a, 189 e, 190 b, 191 a, 192 c, 193 e, 194 d, 195 a, 196 c, 197 b, 198 d.

Biochemistry of Lipids

199 c, 200 b, 201 a, 202 a, 203 b, 204 a, 205 d, 206 e, 207 a, 208 c, 209 e, 210 c, 211 e, 212 a, 213 a, 214 b, 215 d, 216 b, 217 e, 218 d, 219 a, 220 e, 221 c, 222 b, 223 a, 224 a, 225 b, 226 c, 227 e, 228 c, 229 d, 230 e, 231 a, 232 e, 233 d, 234 c, 235 c, 236 a, 237 d, 238 b, 239 e, 240 a, 241 d, 242 b, 243 b, 244 a, 245 a, 246 a, 247 d, 248 d, 249 e, 250 c, 251 e, 252 c, 253 b, 254 d, 255 e, 256 c, 257 c, 258 d, 259 c, 260 a, 261 a, 262 d, 263 b, 264 a, 265 e, 266 d, 267 e, 268 c, 269 a, 270 d, 271 e, 272 a, 273 d