Content of metabolism in questions

These are not the real test questions!

Real test questions will be similar to these so will be the answers.

(The questions could be used to test students alone from the content of biological oxidation and metabolism of carbohydrates lipids and amino acids. See the end of the file for the correct answers it is possible that rewriting the answer to the end of the file can cause some error. We do not guarantee 100% accuracy.)
Authors

1. In digestion of carbohydrates from the food:
   a) participate enzymes of stomach mucosa
   b) participate enzyme formed in pancreas
   c) glycosidic bond is hydrolyzed
   d) starch is broken by amylase into free glucose

2. Which statement about digestion of carbohydrates is correct:
   a) starch is broken by amylase into disaccharide maltose
   b) water is required
   c) amylase is the most important enzyme
   d) amylase hydrolazes all carbohydrates form food

3. Main source of glucose for newborn:
   a) is compound present in fruits
   b) is compound with β-1,4-glycosidic bond
   c) is lactate
   d) is compound which is hydrolyzed to glucose and fructose

4. Product of the action of amylase into starch is:
   a) compound which belongs to polysaccharides
   b) disaccharide maltose
   c) disaccharide glucose
   d) compound which is directly absorbed into blood

5. Pyruvate:
   a) is final product of complete oxidation of glucose in red blood cells
   b) is formed as final product of glucose oxidation in brain
   c) is formed as final product of glycolysis in aerobic conditions
   d) is compound synthesis of which proceeds in cytosol

6. Substrate for alcoholic fermentation is:
   a) monosaccaride glucose
   b) pyruvate
   c) compound which is oxidized by glycolysis
   d) compound which is oxidized by glycogenolysis

7. Activation of glucose:
   a) requires ATP as source of energy

b) is conversion of glucose into glucose-6-phosphate
c) is required for connection of glucose with glycolysis, glycogen synthesis and pentose phosphate pathway
d) in liver is catalyzed mainly by hexokinase with high affinity to glucose

8. During activation of glucose:
a) glucose-1-phosphate is formed
b) ATP i required
c) in extrahepatic tissues glucokinase with high specificity is required
d) in liver glucokinase with low affinity is required

9. Glucokinase is enzyme which:
a) is responsible for phosphorylation of glucose
b) is present in all tissues of human body
c) can catalyze phosphorylation of all hexoses
d) is not inhibited by product of reaction – glucose-6-phosphate

10. Glucokinase:
a) is enzyme typical for liver tissue
b) uses glucose as substrate
c) is enzyme with high K_m for glucose
d) catalyzes phosphorylation of glucose when its concentration is low – during starvation

11. When glucose is activated before entering metabolic processes:
a) ATP is used as source of energy
b) depending on type of tissue either hexokinase or gucokinase is used
c) enzyme present in cytosol is required
d) glucose-6-phosphate is formed

12. Glucose-6-phosphate is compound which:
a) is product of glucose activation
b) is formed in reversible reaction
c) in EHT is formed by high-affinity hexokinase
d) in gluconeogenesis is changed by reversible reaction of glycolysisi into free glucose

13. Glucokinase and hexokinase are enzymes which:
a) are responsible for glucose transport to the cells
b) are responsible for activation
c) both are present in all tissues of human body
d) lead to synthesis of glucose-6-phosphate

14. Enzyme hexokinase:
a) catalyzes one of four irreersible reactions of glycolysis
b) as substrate uses glucose only
c) in low glucose concentration is not active because of low K_m for glucose
d) is resonsible for glycogen degradation

15. Glucose-6-phosphate enters metabolic processes:
a) which are located in mitochondria and cytosol
b) as is for example glycolysis located in cytosol
c) as is for example pentose phosphate pathway located in mitochondria
d) as is for example synthesis of glycogen located in lysosomes

16. Processes which utilize glucose-6-phosphate:
a) are processes function of which is synthesis of ATP only

b) are processes which proceed only in aerobic conditions
c) is for example glycolysis which allows synthesis of ATP also in anaerobic conditions
d) is for example synthesis of glycogen

17. Reaction of glucose with ATP:
a) is reaction of glucose activation before entering glycolysis
b) is reaction of glucose activation for synthesis of glycogen
c) in liver is catalyzed by glucokinase
d) is reversible reaction

18. Conversion of glucose-6-phosphate to fructose-6-phosphate:
a) is catalyzed by phosphoglucomutase
b) is required for degradation of glucose by glycolysis
c) is reversible reaction
d) is important regulatory enzyme of glycolysis

19. Change of glucose-6-phosphate to fructose-6-phosphate:
a) is catalyzed by phosphohexoisomerase
b) is irreversible reaction
c) is reaction important for glycogen synthesis
d) is reaction of glycolysis

20. Phosphofructokinase catalyzes reaction which:
a) is reversible
b) leads to synthesis of fructose-6-phosphate
c) is activated by ATP
d) is activated during starvation

21. Reaction catalyzed by phosphofructokinase:
a) leads to synthesis of fructose-1,6-bisphosphate
b) is key regulatory step of glycolysis
c) is irreversible
d) is reaction activated by fructose-2,6-bisphosphate

22. Key regulatory reaction of glycolysis is:
a) reaction of conversion of fructose-6-phosphate to fructose-1,6-bisphosphate
b) reaction of fructose-6-phosphate synthesis
c) reaction which is inhibited by ATP, $NADH+H^+$
d) reaction which is activated by phosphorylation of the enzyme

23. Which of following compounds influence activity of phosphofructokinase I:
a) ATP as inhibitor
b) ADP, AMP, NAD as inhibitors
c) citrate as activator
d) fructose-2,6-bisphosphate which allows its reaction despite high concentration of ATP

24. Inhibition of phosphofructokinase by ATP:
a) belongs to metabolic regulation of glycolysis
b) can be removed by ADP
c) can be removed by fructose-2,6-bisphosphate
d) can be removad by compound which is foprmed in presence of glucagon

25. Glyceraldehyde-3-phosphate and dihydroxyacetonephosphate are compounds which:
a) are formed in cytosol
b) are intermediates of pentose phosphate pathway

c) are formed form fuctose-6-phosphate
d) can be interconverted by tiosephosphate isomerase

26. Cleavage of fructose-1,6-bisphosphate in glycolysis:
a) is catalyzed by enzyme aldolase
b) is hydrolytic reaction
c) leads to synthesis of two phosphorylated aldotrioses
d) leads to synthesis of glyceraldehyde phosphate and dihydroxyacetonephosphate

27. Reaction of fructose-1,6-bisphosphate conversion in glycolysis:
a) is catalyzed by enzyme which belongs to lyases
b) is catalyzed by phosphofructokinase
c) leads to synthesis of glyceraldehyde-3-phosphate which is further metabolized in glycolysis
d) is inhibited by ATP

28. Triosephosphate isomerase catalyzes reaction:
a) in which water is required
b) in which phosphorylated aldotriose is changed to phosphorylated ketotriose
c) which is reversible
d) which is required also for connection of alcoholic component of triacylglycerols to gluconeogenesis

29. Intermediate of glycolysis which can be used for synthesis of triacylglycerols:
a) is dihydroxyacetonephosphate
b) is pyruvate
c) for synthesis of triacylglcerols is changed by its reduction
d) is changed in reaction catalyzed by glycerolphosphate dehydrogenase

30. Change of dihydroxyacetonephosphate to glycerolphosphate:
a) is reversible reaction
b) is catalyzed by glycerophosphatedehydrogenase
c) is not important for gluconeogenesis
d) is important also for transport of reducing equivalents from cytosol into mitochondria – shuttles

31. Dihydroxyacetonephosphate is changed to glycerolphosphate:
a) by reaction which is irreversible
b) by oxidation catalyzed by glycerolphosphate dehydrogenase
c) by reaction which is important for glycolysis
d) by reaction which uses $FADH_2$ as coenzyme

32. Glycerolphosphate dehydrogenase is the enzyme which:
a) catylazes reversible reaction
b) is important for gluconeogenesis
c) is important for synthesis of fatty acids
d) in mitochondria uses FAD as coenzyme

33. Reaction catalyzed by glycerolphosphate dehydrogenase:
a) is irreversible
b) in mitochondria uses NAD as coenzyme
c) is important for synthesis of triacylglycerols
d) does not proceed in cytosol

34. During oxidation of glyceraldehyde-3-phosphate in glycolysis:
a) enzyme glycerolphosphate dehydrogenase is used

b) intermediate of reaction contains thioester energy rich bond
c) $NADPH_2$ is formed
d) coenzyme of reaction is FAD

35. Product of reaction catalyzed by glyceraldehyde-3-phosphate dehydrogenase:
a) is compound with two energy rich bonds
b) is compound with thioester energy rich bond
c) is compound which is used for synthesis of ATP by substrate level phosphorylation
d) is compound which is changed by glycerolkinase

36. During oxidation of one glyceraldehyde-3-phosphate in aerobic conditions:
a) the same amount of ATP as in anaerobic conditions is formed
b) 3 ATP by oxidative phosphorylation are formed
c) 1 ATP by substrate level phosphorylation is formed
d) totally 6 ATP are formed

37. When glyceraldehyde-3-phosphate is oxidized in glycolysis:
a) ATP by oxidative phosphorylation is formd only in aerobic conditions
b) in aerobic conditions by 1 more ATP is formed than in anaerobic conditions
c) reaction allow synthesis of 1 ATP in both aerobic and anaerobic conditions
d) in anaerobic conditions ATP is formed only by oxidative phosphorylation

38. Reaction of conversion glyceraldehyde-3-phosphate $\longrightarrow$ 1,3-bis-phosphoglycerate $\longrightarrow$ 3-phosphoglycerate allows synthesis of:
a) the same amount of ATP is formed in both aerobic and anaerobic conditions
b) 1 ATP by substrate level phosphorylation only in anaerobic conditions
c) ATP only in aerobic conditions
d) 3 ATP by oxidative phosphorylation in aerobic conditions

39. Different asmounts of ATP by oxidation of glyceraldehyde-3-phosphate in aerobic and anaerobic conditions are formed because:
a) in anaerobic conditions does not proceed terminal oxidation
b) in anaerobic conditions does not proceed Krebs cycle
c) in aerobic conditions ATP can be forme also by oxidative phosphorylation
d) in anaerobic conditions reduced coenzyme transfers hydrogens to pyruvate and not to terminal oxidation

40. Glyceraldehyde-3-phosphate dehydrogenase is responsible for synthesis of:
a) 3-phosphoglycerate
b) compound with acylphosphate energy rich bond
c) compound which is changed by phosphoglycerate kinase
d) compound which is used for synthesis of ATP by substrate level phosphorylation in all cells of human body

41. Conversion of 1,3-bisphosphoglycerate in glycolysis:
a) is catalyzed by glycerolkinase
b) requires ATP as substrate
c) is reaction of phosphorylation at the substrate level
d) allows synthesis of 2 ATP per one glucose

42. Substrate for phosphoglyceratekinase is compound which:
a) is 1,3-bisphosphoglycerate
b) is formed by glycerolphosphate dehydrogenase
c) contains enolphosphate energy rich bond
d) allows synthesis of ATP by substrate level phosphorylation

43. Phosphoglycerate kinase in glycolysis catalyzes conversion of:
    a) 3-phosphoglycerate
    b) 1,3-bisphosphoglycerate
    c) compound which is product of glyceraldehyde-3-phosphate dehydrogenase
    d) compound which contains phosphoanhydride energy rich bond

44. Phosphoglycerate kinase:
    a) catalyzes reversible reaction
    b) catalyzes synthesis of 1,3-bisphosphoglycerate in glycolysis
    c) catalyzes synthesis of 1,3-bisphosphoglycerate in gluconeogenesis
    d) uses energy of acylphosphate energy rich bond for synthesis of ATP by substrate level phosphorylation

45. Phosphoglycerate mutase catalyzes::
    a) reversible reaction
    b) conversion of 1,3-bisphosphoglycerate to 3-phosphoglycerate
    c) synthesis of 2-phosphoglycerate in glycolysis
    d) conversion of 2-phosphoglycerate in gluconeogenesis

46. 1,3-bisphosphoglycerate:
    a) is formed by glyceraldehyde-3-phosphate dehydrogenase in glycolysis
    b) is formd by irreversible reaction
    c) contains phosphate bound by acylphosphate energy rich bond to C_1
    d) contains phosphate boud by phosphoester bond to C_3

47. 2-phosphoglycerate in glycolysis is changed:
    a) by phosphoglycerate kinase
    b) by reversible reaction
    c) to phosphoenolpyruvate
    d) to compound with acylphosphate energy rich bond

48. Conversion of 2-phosphoglycerate in glycolysis:
    a) is catalyzed by enzyme enolase
    b) is irreversible reaction
    c) requires ATP
    d) leds to synthesis of compound which can be used for synthesis of ATP by substrate level phosphorylation

49. Compound formed by the action of enolase in glycolysis:
    a) is enolpyruvate
    b) is substrate for pyruvate kinase
    c) contains enolphosphate energy rich bond
    d) is used for synthesis of ATP by substrate level phosphorylation only in anaerobic conditions

50. Enolase is enzyme which:
    a) catalyzes reversible reaction
    b) uses 2-phosphoglycerate as substrate
    c) leads to synthesis of phosphoenolpyruvate
    d) produces phosphoenolpyruvate only in anaerobic conditions

51. Compound with enolphosphate energy rich bond:
    a) is 1,3-bisphosphoglycerate
    b) in glycolysis is formed by pyruvate kinase
    c) in glycolysis is formed by reversible reaction

d) is the only compound for synthesis of ATP by substrate level phosphorylation

52. Enolphosphate energy rich bond contains:
a) compound which is product of enolase
b) phosphoenolpyruvate
c) compound conversion of which requires ATP
d) compound which in gluconeogenesis is formed by pyruvate kinase

53. Pyruvate kinase:
a) catalyzes irrevesible reaction
b) catalyzes synthesis of phosphoenolpyruvate
c) catalyzes synthesis of ATP in aerobic and anaerobic conditions
d) is active in dephosphorylated form

54. In regulation of pyruvate kinase activity:
a) ATP acts as inhibitor
b) fructose-1,6-bisphosphate is activator
c) glucagon inhibits the enzyme by phosphorylation
d) insulin couses activation of the enzyme by its phosphorylation

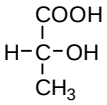
55. Further conversion of phosphoenolpyruvate in glycolysis:
a) is catalyzed by pyruvate kinase
b) utilizes energy of enolphosphate bond for synthesis of ATP
c) is inhibited by high concentration of ATP
d) is activated during starvation by hormone glucagon

56. In conversion of phosphoenolpyruvate in glycolysis:
a) enzyme enolase is used
b) ATP is required as substrate
c) GTP is formed
d) enzyme which is active in dephosphorylated form is used

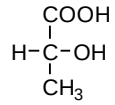
57. Fructose-1,6-bisphosphate influences enzymes of glycolysis that:
a) inhibits phosphofructokinase I
b) activates phosphofructokinase II
c) activates reaction of phosphoenolpyruvate synthesis
d) activates pyruvate kinase

58. Pyruvate in glycolysis is synthesized by:
a) reversible reaction
b) reaction which allows synthesis of ATP in anaerobic conditions
c) reaction which is important also for gluconeogenesis
d) reaction which is active in presence of insulin which causes dephosphorylation of the enzyme responsible for the reaction

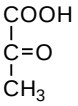
59. In aerobic conditions in glycolysis:
a) 2 mol lactate are formed per 1 mol of glucose
b) 2 mol of acetyl-CoA are formed per 1 mol of glucose
c) 2 mol of CO_2 are formed per 1 mol of glucose
d) by reoxidation of reduced coenzyme formed by convesrion of 1 mol of glucose 6 ATP can be formed

60. Reaction $C_6H_{12}O_6 + 2\ ADP + 2\ P \rightarrow 2$  $+ 2\ ATP$:

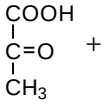
a) is summary reaction of complete glucose oxidation in aerobic conditions
b) is summary reaction of aerobic glycolysis
c) is typical for oxidation of glucose in brain
d) is reaction which proceeds in lack of oxygen

61. Summary reaction $C_6H_{12}O_6 + 2\ ADP + 2\ P \rightarrow 2$  $+ 2\ ATP$:

a) is reaction of complete glucose oxidation on erythrocytes
b) represents process located in cytosol
c) represents process which allows synthesis of 2 ATP in reaction catalyzed by phosphoglycerate kinase
d) represents complete glucose oxidation in heart

62. Reaction $C_6H_{12}O_6 + 8\ (6)\ ADP + 8\ (6)P \rightarrow 2$  $+ 8\ (6)ATP$:

a) is summary reaction of complete glucose oxidation in aerobic conditions
b) is reaction of complete glucose oxidation in brain
c) represents the process which allows synthesis of 6 ATP by oxidative phosphorylation
d) represents the process which allows synthesis of 2 ATP by substrate level phosphorylation

63. Reaction $C_6H_{12}O_6 + 8\ (6)\ ADP + 8\ (6)P \rightarrow 2$  $+ 8\ (6)ATP$:

a) is summary reaction of the process which proceeds in cytosol
b) represent process in which ATP is formed by substrate level and oxidative phosphorylation
c) represents process which allows synthesis of 6 ATP by reoxidation of $NADH_2$
d) leds to synthesis of the product further conversion of which is located in mitochondria

64. Process which can be expressed by summary reaction $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 38$ ATP:
a) means summary reaction of aerobic glycolysis
b) involves processes which proceed in cytosol and mitochondria
c) requires processes: glycolysis, oxidative decarboxylation of pyruvate and Krebs cycle
d) is characteristic for glucose oxidation in red blood cells

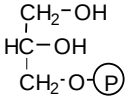
65. Process expressed by summary reaction $C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 38\ ATP$:
a) means complete glucose oxidation in aerobic conditions
b) allows synthesis of 8 ATP in aerobic glycolysis
c) allows synthesis of 6 ATP in reaction catalyzed by pyruvate dehydrogenase
d) leads to synthesis of 6 CO_2 via Krebs cycle

66. Oxidation of glucose which is expressed by summary reaction:
$C_6H_{12}O_6 + 6\ O_2 \rightarrow 6\ CO_2 + 6\ H_2O + 38\ ATP$:
a) is oxidation of glucose typical for intensively working muslce
b) allows synthesis of 2 ATP by phosphorylation at the substrate level
c) allows synthesis of 12 ATP in Krebs cycle

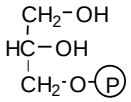
d) represents mode of glucose oxidation for example during heart attack

67. During complete aerobic oxidation of glucose:
a) 2 mol of pyruvate are formed
b) 2 CO_2 are formed in the process which requires thiaminepyrophosphate
c) 24 ATP are formed in Krebs cycle
d) by process of oxidative phosphorylation totally 24 ATP are formed

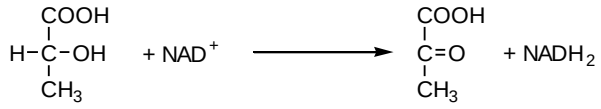
68. Complete aerobic oxidation of glucose:
a) leds to synthesis of 6 ATP by oxidative phosphorylation in glycolysis
b) leads to synthesis of 4 CO_2 in Krebs cycle
c) leds to synthesis of 6 ATP by substrate level phosphorylation
d) requires thiaminepyrophosphate for the reaction located in cytosol

69.  is compound:

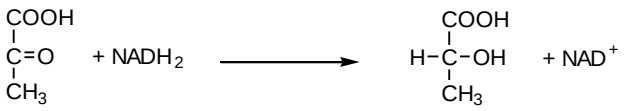
a) which is formed by reduction of glyceraldehyde-3-phosphate
b) which is formed by the action of glycerolphosphate dehydrogenase
c) synthesis of which requires $NADH_2$
d) can be used for gluconeogenesis

70. Compound of the formula: 

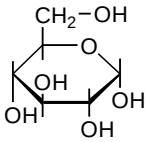
a) is subtrate of glycerophospate dehydrogenase
b) is product of glycerolphosphate dehydrogenase
c) is formed in reaction important for connection of alcoholic component of triacylglycerol to gluconeogenesis
d) in adipose tissue can be formed by glycerolkinase

71. Reaction: 

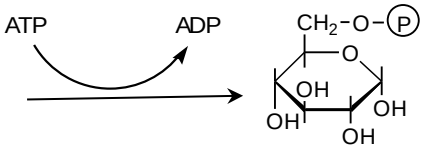
a) is catalyzed by lactate dehydrogenase
b) in given direction is important for utilization of lactate in gluconeogenesis
c) is component of Cori's cycle
d) in given direction is required for reoxidation of $NADH_2$ in aerobic conditions

72. Reaction: 

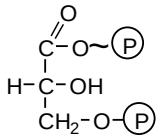
a) proceeds in anaerobic conditions
b) is irreversible reaction
c) proceeds for example in red blood cells
d) leads to synthesis of compound which can cause acidosis

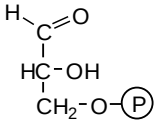
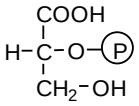


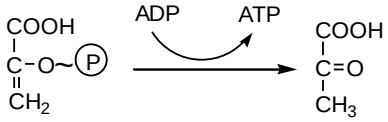
73. Reaction:



a) in liver is catalyzed by glucokinase
b) belongs to reversible reactions of glycolysis
c) is reaction of gluconeogenesis
d) leads to synthesis of compound which is substrate of phosphohexoisomerase

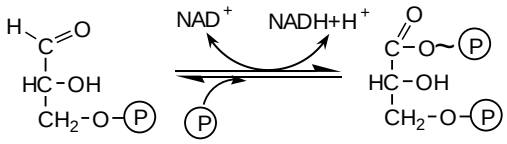
74. Compound  :

a) is product of glycerolphosphate dehydrogenase
b) is compound with acylphosphate energy rich bond
c) is formed in glycolysis from substrate 
d) is substrate of reaction which produces 

75. Reaction: 

a) is catalyzed by pyruvate kinase
b) allows synthesis of ATP in anaerobic conditions
c) is activated by fructose-1,6-bisphosphate
d) is activated by glucagon during starvation

76. Which of following enzymes catalyzes reaction:



a) triosephosphate isomerase
b) glyceraldehyd-3-phosphate dehydrogenase
c) phosphoglycerate mutase
d) enzyme coenzyme of which allows synthesis of 3 ATP

77. Phosphorylation at the substrate level by means of utilization of acylphosphate energy rich bond:
    a) requires: oxidation of glyceldehyde-3-phosdphate and hydrolytic cleavage of 1,3-bisphosphoglycerate
    b) requires enzymes glyceraldehyde-3-phosphate dehydrogenase and phosphoglycerate kinase
    c) is reversible reaction
    d) allows synthesis of 2 mol of ATP per 1 mol of glucose

78. Phosphorylation at the substrate level by means of utilization of enolphosphate energy rich bond:
    a) requires enzymes enolase and pyruvate kinase
    b) requires dehydrogenaztion of pyruvate and conversion of phosphoenolpyruvate to pyruvate
    c) allows synthesis of ATP only in anaerobic conditions
    d) is important reaction for synthesis of ATP in erthrocytes

79. Anaerobic glycolysis:
    a) is the only possibility for ATP synthesis in red blood cells
    b) is the process which allows synthesis of ATP by oxidative phosphorylation
    c) is main source of energy for all cells of human body
    d) leads to synthesis of 6 ATP per 1 glucose

80. Aerobic glycolysis:
    a) is the only source of energy for brain
    b) leads to synthesis of acetyl-CoA
    c) is the process which proceeds in cytosol of all cells of human body
    d) leads to synthesis of compound which is further metabolized in mitochondria

81. Which of statements about aerobic glycolysis are correct:
    a) leads to synthesis of 2 mol of pyruvate per 1 mol of glucose
    b) produces by substrate level phsohprylation the same amount of ATP as anaerobic glycolysis
    c) its intermediate can be used for synthesis of triacylglycerols
    d) is activated by phosphrylation of enzymes in presence of glucagon

82. In metabolic regulation of glycolysis participate:
    a) ADP as acivator pf phosphofructokinase
    b) glucose-6-phosphate as inhibitor of hexokinase
    c) fructose-1,6-bisphosphate as activator of pyruvate kinase
    d) ATP and $NADH_2$ as inhibitors of phosphofructokinase

83. $NADH_2$ formed in reaction catalyzed by glyceraldehyde-3-phosphate dehydrogenase can be used for synthesis of ATP by oxidative phosphorylation:
    a) after its transfer into mitochondria by diffusion
    b) after its transfer into mitochondria by active transport
    c) by transfer of hydrogens into mitochondria by malate/glutamate shuttle
    d) by transfer of hydrogens into mitochondria by glycerolphosphate/dihydroxyacetone phosphate shuttle

84. Which of statements about transport of reduciong equivalents from cytosol into mitochondria is correct:
    a) is important because mitochondrial membrane is impermeable for $NADH_2$
    b) is important for utilization of reduced coenzymes formed by oxidation of fatty acids
    c) malate/aspartate shuttle allows synthesis of 3 ATP
    d) glycerolphosphate/dihydroxyacetonephosphate allows synthesis of 1 ATP more than malate/aspartate shuttle

85. Which of following reactions of glycolysis are irreversible:
    a) reaction of fructose-1,6-bisphosphate synthesis

b) reaction catalyzed by pyruvate kinase
c) reaction of fructose-6-phosphate synthesis
d) reaction of substrate level phosphorylation which uses phosphoenolpyruvare

86. In the process of aerobic glycolysis.
a) activation of glucose requires 2 ATP
b) by substrate level phosphorylation 4 ATP are formed
c) lactate as final product is formed
d) compound with thioester energy rich bond is formed as final product

87. During aerobic glycolysis:
a) 2 CO_2 are formed
b) 2 ATP are formed by substrate level phosphorylation
c) 6 ATP can be formed by reoxidation of $NADH_2$ in mitochondria
d) 12 ATP can be formed per 1 glucose

88. Reaction typical for anaerobic glycolysis is:
a) conversion of pyruvate to lactate
b) reaction which is required for regeneratzion of oxidized form of NAD
c) reaction catalyzed by pyruvate kinase
d) reaction typical for oxidation of glucose in brain

89. Reaction of conversion of pyruvate to lactate:
a) is catalyzed by lactate dehydrogenase
b) proceeds in cytosol
c) is reversible reaction
d) is final step of the process by which red blood cells gain energy

90. Lactate dehydrogenase catalyzes reaction:
a) which uses pyruvate as substrate
b) synthesis of pyruvate from lactate for gluconeogenesis in liver
c) of transfer of hydrogens from $NADH_2$ to pyruvate in good oxygen supply
d) which is regulatory step of glycolysis in red blood cells

91. Anaerobic glycolysis produces less ATP than aerobic glycolysis because:
a) in anaerobic conditions does not proceed Krebs cycle
b) in aerobic conditions ATP is formed also by oxidative phosphorylation
c) in aerobic conditions ATP is formed also by oxidation of $NADH_2$
d) in anaerobic conditions lactate is formed

92. Conversion of pyruvate to lactate:
a) is typical for anaerobic glycolysis
b) in anaerobic conditions is required because $NADH_2$ cannot be oxidized in terminal oxidation
c) is final reaction of glycolysis in red blood cells
d) is irreversible

93. Production of lactate in working muscle:
a) is catalyzed by lactate dehydrogenase
b) is consequence of relative lack of oxygen during work
c) is ireversible reaction
d) in higher concentrations can cause acidosis

94. Red blood cells gain energy in metabolic process which:
a) is the only source of energy in anaerobic conditions
b) produces lactate as final product

c) leads to synthesis of compound which in red blood cells cannot be matabolized
d) leads to synthesis of compound which can be used for gluconeogenesis

95. Source of energy for red blood cells can be:
a) only glucose
b) fatty acids during starvation
c) ketone bodies during starvation
d) compound which in red blood cells is oxidized by anaerobic glycolysis

96. Conversion of lactate to pyruvate:
a) is catalyzed by lactate dehydrogenase
b) proceeds in tissues in lack of oxygen
c) allows utilization of lactate in gluconeogenesis
d) uses coenzyme which allows synthesis of 3 ATP by oxidative phosphorylation

97. Cori´s cycle:
a) connects anaerobic glycolysis in muscles and gluconeogenesis in liver
b) utilizes lactate formed in liver vfor synthesis of ATP in heart
c) in liver utilizes lactate formed in tissues in anaerobic conditions
d) in the liver requires enzyme lactate dehydrogenase

98. Compound with acylphosphate energy rich bond in glycolysis:
a) is formed by glycerolphosphate dehydrogenase
b) is formed by reaction which requires FAD as coenzyme
c) contains two phosphate residues bound by energy rich bond
d) is used for synthesis of ATP by substrate level phosphorylation using enzyme glycerolkinase

99. Which of statments about intermediates of glycolysis with energy rich bonds are true:
a) it is for example 1,3-bisphosphoglycerate
b) it is enolpyruvate
c) all are formed by irreversible reactions
d) process of ATP synthesis using energy of energy rich bonds is called substrate level phosphorylation

100. Intermediates of glycolysis with energy rich bond:
a) are totally three
b) are compounds formed in reversible reactions of glycolysis
c) are compound used for synthesis of ATP in both aerobic and anaerobic conditions
d) are used for synthesis of ATP in reversible reactions of glycolysis

101. In the process of anaerobic glycolysis:
a) cells can form 2 ATP by oxidation of one glucose
b) lactate is formed during reoxidation of $NADH_2$
c) for activation of glucose 1 ATP is spent
d) is important synthesis of compounds with energy rich bonds

102. $NADH_2$ in anaerobic glycolysis is oxidized by:
a) reaction in which lactate is formed
b) reaction which proceeds in cytosol
c) reaction of substrate level phsohorylation
d) synthesis of compound which can be used for gluconeogenesis

103. Which cells of human body use glucose as the only source of energy:
a) brain tissue
b) heart cells

c) red blood cells which by glucose oxidation gain 6 ATP
d) red blood cells which can form ATP only by substrate level phosphorylation

104. Lactate:
a) is formed as final product of glycolysis in brain
b) is formed in higher concentrations in lack of oxygen
c) in heart can be used for ATP synthesis
d) as final product of metabolism is excreted by kidneys

105. Which of following tissues is almost completely dependent on glucose as source of energy:
a) brain which during stavation can use also ketone bodies
b) red blood cell which during starvation oxidize also fatty acids
c) heart because requires large amounts of ATP
d) brain becasue does not contain mitochondria

106. Which statements about regulation of glycolysis are correct:
a) key regulatory enzyme is reaction of fructose-1,6-bisphosphate synthesis
b) high concentrations of ATP and $NADH_2$ inhibit phosphofructokinase and pyruvate kinase
c) glucagon by phosphorylation of tandem enzyme increases concentration of fructose-2,6-bisphosphate inhibits phosphofructokinase I
d) insulin by dephosphorylation of pyruvate kinase causes its activation

107. Gluconeogenesis is the process which:
a) proceeds only in liver
b) leads to synthesis of glucose form glycogen
c) allows synthesis of glucose mainly form amino acids
d) is activated by insulin

108. Gluconeogenesis:
a) is the process of glucose synthesis from fatty acids
b) proceeds in liver and kidneys
c) is not important because during starvation glucose is synthesized by glycogen degradation
d) is activated by glucocorticoids

109. For glucose synthesis by gluconeogenesis can be used:
a) lactate
b) amino acids – for example alanine
c) alcoholic component of triacylglycerols
d) amino acids which can be changed to acetyl-CoA

110. Organism can use for glucose synthesis by gluconeogenesis:
a) fatty acids
b) ketone bodies
c) glucogenic amino acids
d) amino acid leucine

111. Pyruvate carboxylase is the enzyme which:
a) is located in mitochondria
b) as substrate uses compound formed form lactate
c) requires GTP as source of energy
d) is activated by phosphorylation in presence of glucagon

112. Phosphoenolpyruvate carboxykinase:
a) uses pyruvate as substrate
b) catalyzes reaction of glycolysis

c) requires biotin as coenzyme
d) requires ATP as source of energy

113. Phosphoenolpyruvate carboxykinase is the enzyme which:
a) leads to synthesis of phosphoenolpyruvate
b) catalyzes conversion of phosphoenolpyruvate in gluconeogenesis
c) requires GTP as source energy
d) uses oxaloacetate as substrate

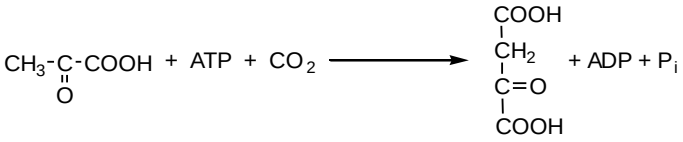
114. For synthesis of free glucose in the process of gluconeogenesis is responsible enzyme:
a) glucose-6-phosphate phosphatase
b) which requires water as one of substrate of reaction
c) present in liver and kidneys
d) which participates also in glycogen degradation in muscles

115. Conversion of glucose-6-phopsphate into free glucose catalyzes enzyme:
a) present only in liver
b) glucokinase
c) required for glucose synthesis for irreversibility of reaction catalyzed by glucokinase
d) which is required only for gluconeogenesis

116. Substrate for phosphoenolpyruvate carboxykinase is:
a) oxaloacetate
b) product of pyruvate dehydrogenase
c) compound which is formed form fatty acids
d) compound for synthesis of which GTP is required

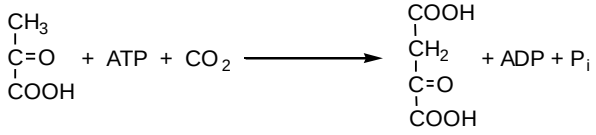
117. Enzyme of gluconeogenesis which produces compound with enolphosphate energy rich bond:
a) is pyruvate kinase
b) is enolase
c) uses as substrate oxaloacetate
d) requires specific source of energy GTP

118. Reaction:



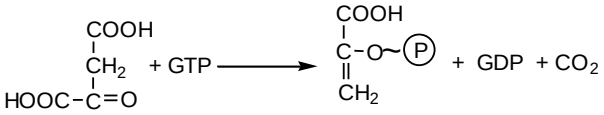
a) proceeds in cytosol
b) is activated by acetyl-CoA
c) is catalyzed by pyruvatekinase
d) is activated by insulin durong starvation

119. Pyruvate carboxylase:
a) catalyzes reaction



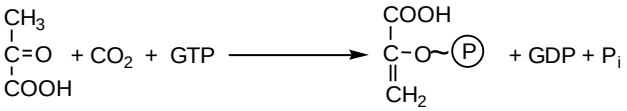
b) catalyzes reaction which proceeds in liver and kidneys
c) is located in mitochondria
d) is induced by cortisol

120. Synthesis of phosphoenolpyruvate from oxaloacetate proceeds:

a) by reaction 

b) by reaction catalyzed by phosphoenolpyruvatecarboxykinase
c) by reaction which is inhibited during starvation
d) in the process which allows utilization of lactate and glucogenic amino acids for glucose synthesis

121. Phosphoenolpyruvate carboxykinase:
a) catalyzes reaction



b) is located in cytosol and mitochondria
c) is enzyme activity of which is increased in hyperglyceamia
d) is important enzyme for synthesis of glucose by gluconeogenesis

122. Gluconeogenesis:
a) is important for glucose synthesis during starvation
b) is the process in which irreversible reactions of glycolysis are bypassed by specific enzymes
c) is process which allows utilization of ketone bodies for glucose synthesis
d) is the process activated by hormone formed in α-cells of Langerhans islets of pancreas

123. During long starvation:
a) liver glycogen is main source of blood glucose
b) organism uses fatty acids for gluconeogenesis
c) gluconeogenesis is activated by insulin
d) main substrate for gluconeogenesis are glucogenic amino acids

124. During long starvation:
a) level of glucose does not decrease to zero because glucose can be formed by gluconeogenesis
b) cortisol increases degradation of tissue protein and induces enzymes of gluconeogenesis in liver
c) source of energy for brain are ketone bodies and glucose
d) insulin is the main activator of gluconeogenesis

125. Process of gluconeogenesis:
a) proceeds in liver, kidneys and skeletal muscles
b) requires specific source of energy – CTP
c) for the brain is not important because brain durng starvation uses fatty acids and ketone bodies
d) requires specific enzymes for example – pyruvate carboxylase, phosphenolpyruvate carboxykinasee and two phosphatases

126. Which of following enzymes are required for glucose synthesis by gluconeogenesis:
a) pyruvate carboxylase
b) pyruvate kinase
c) glucose-6-phosphate phosphatase
d) glucokinase

127. Acetyl-CoA can not be for gluconeogenesis because:

a) its conversion to pyruvate is not possible
b) reaction catalyzed by pyruvate dehydrogenase is not reversible
c) reaction catalyzed by pyruvate kinase is not reversible
d) during starvation is not formed

128. Connection of proteins with gluconeogenesis:
a) is not important because glucose is synthesized only from lactate
b) requires proteases mainly in liver
c) requires lactate dehydrogenase
d) requires reactions by which amino acids are changed to keto acids

129. Part of triacylglycerols which can be used for gluconeogenesis:
a) is glycerol
b) is glycerol formed by hydrolysis of TAG by pancreatic lipase
c) is chain of fatty acid
d) is compound which is activated by glycerol kinase

130. Connection of glycerol with process of gluconeogenesis requires:
a) enzyme glycerolkinase in adipose tissue
b) enzyme glycerolkinase in liver
c) enzyme which changes glycerolphosphate to dihydroxyacetonephosphate
d) ATP as source of energy

131. Gluconeogenesis is influenced by:
a) hormone of α-cells of Langerhans islets which increases level of cAMP and by phosphorylation activates enzymes of gluconeogenesis
b) hormone of β- cells of Langerhans islets which causes of enzymes of glycolysis and by this way activation of gluconeogenesis
c) cortisol which after bindimg to cytosoloc receptor increases production of enzymes required for synthesis of glucose by gluconeogenesis
d) hormone secreted from pancreas during starvation which causes phosphorylation of pyruvate kinase and by this way allows utilization of phosphoenolpyruvate in gluconeogenesis

132. Glygogen is compound:
a) which contains α-1,4 and α-1,6-glycosidic bonds
b) which storage of glucose mainly in brain
c) for synthesis of which UTP is required
d) degradation of which is activated by glucagon

133. Intermediate of glycogen synthesis is:
a) compound formed by phosphoglucomutase
b) compound formed form glucose-6-phosphate and UTP
c) compound which contains phosphoanhydride energy rich bond
d) compound which is formed also as intermediate during digestion of glycogen in intestine

134. UDP-glucose is compound which:
a) is formed from glucose-1-phosphate and UTP
b) is substrate for glycogephosphorylase
c) is formed in both synthesis and degradation of glycogen
d) is required also during conversion of glucose to galactose

135. Glucose-1-phosphate during glycogen synthesis:
a) is formed by glucokinase
b) is formed by reversible reaction
c) is formed by reaction which requires UTP

d) is formed by the same enzyme as glucose-1-phosphate during glycogen degradation

136. Glucose-1-phosphate in metabolism of glycogen:
a) is intermediate of glycogen synthesis
b) during degradation is formed by glycogenphosphorylase
c) during synthesis of glycogen is formed by phosphoglucomutase
d) during degradation of glycogen is changed by phosphoglucomutase

137. Further conversion of glucose-1-phosphate in glycogen synthesis:
a) requires ATP as source of energy
b) is catalyzed by phosphoglucomutase
c) is catalyzed by UDPG-phosphorylase
d) leads to synthesis of compound which is substrate for glycogen synthase

138. Further conversion of glucose-1-phosphate in glycogen degradation:
a) requires ATP as source of energy
b) is catalyzed by phosphoglucomutase
c) is catalyzed by UDPG-phosphorylase
d) leads to synthesis of compound which is substrate for glucose-6-phosphate phosphatase

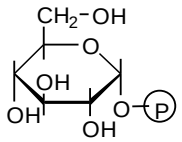
139. Synthesis of UDP-glucose:
a) requires glucose-6-phosphate and UTP as substrates
b) catalyzes enzyme UDPG-phosphorylase
c) is reaction of glucose activation in glycoge synthesis
d) is reversible reaction

140. UDP-glucose is compound:
a) which is formed by reaction of glucose-1-phosphate and UTP
b) which is substrate for glycogensynthase
c) which is formed during glycogen degradation
d) which is substrate for synthesis of α-1,6-glycosidic bond

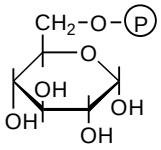
141. Glycogensynthase catalyzes synthesis of:
a) α-1,4-glycosidic bond
b) bond which during degradation is broken by hydrolysis
c) bond which in the liver is broken by glycogenphosphorylase
d) bond which is responsible for branched structure of glycogen

142. α-1,4 glycosidic bond:
a) is responsible for branched structure of glycogen
b) is formed by action of glycogenphosphorylase
c) is bond for synthesis of which UDP-glucose is required
d) is bond which is broken by glygogenphosphorylase into glucose-1-phosphate

143. Glycogensynthase is the enzyme which:
a) uses glucose-1-phosphate as substrate
b) is responsible for synthesis of α-1,6-glycosidic bond
c) is activated by dephosphorylation in presence of insulin
d) is main regulatory enzyme of glycogen synthesis

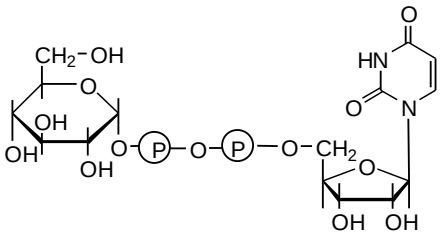
144. Compound: 

a) is substrate for UDPG-phosphorylase
b) is substrate for glycogensynthase
c) is product of digestion of glycogen by amylase
d) is product of glycogen degradation in liver

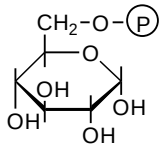
145. Compound: 

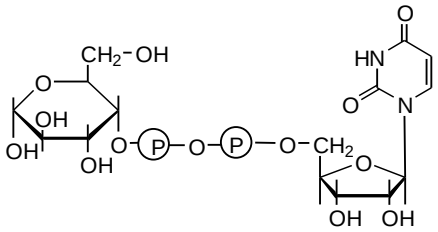
a) by glucose-6-phosphate phosphatase can be changed into free glucose
b) is final product of glycogen degradation in muscles
c) during glycogen degradation is formed by phosphoglucomutase
d) during glycogen synthesis is formed by phosphoglucomutase

146. Uridinediphosphateglucose (UDPG):
a) is compound with formula

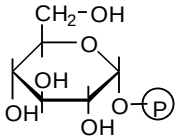


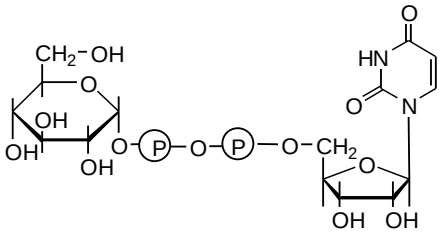
b) is donor of glucose units in glycogen synthesis

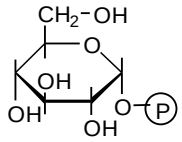
c) is formed by reaction of  and UTP

d) is compound with formula 

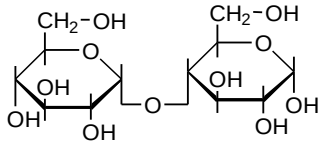
147. Glycogensynthase:
a) catalyzes synthesis of linear chain of glycogen

b) uses as substrate compound 

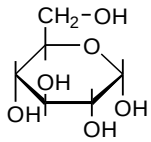
c) requires primer
d) uses as substrate compound 

148. Compound: 

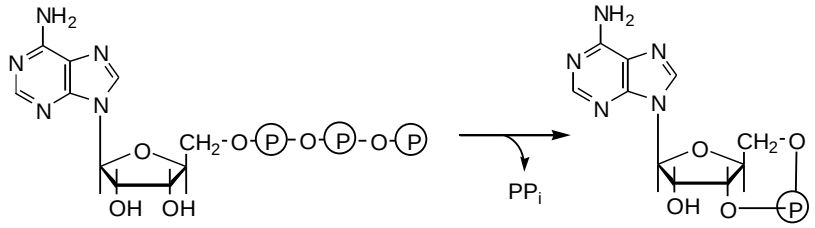
a) is formed by spliting of α-1,6-glycosidic bonds in glycogen
b) is product of pancreatic amylase
c) is formed by spliting of α-1,4-glycosidic bonds by glycogenphosphorylase
d) in glycogen synthesis is changed to UDP-glucose by UDPG-phosphorylase

149. Compound: 

a) is product of maltase
b) is disaccharide maltose
c) is product of glycogenphosphorylase
d) is formed during glycogen hydrolysis in intestine

150. Compound: 

a) is product of glycogen degradation by pancreatic amylase
b) is product of glycogen phosphorylase
c) is formed by glucose-6-phosphate phosphatase during glycogen degradation in muscles
d) is product of glycogen degradatioon by debranching enzyme

151. Reaction: 

a) is activated by glucagon and adrenaline
b) is catalyzed by ATP-ase
c) is reaction of synthesis of 2nd messenger cAMP
d) leads to synthesis of compound which by phosphorylation activates glycogenphosphorylase

152. α-1,6 glycosidic bond:
a) is formed by glycogensynthase
b) is bond for synthesis of which UDP-gucose as substrate is required
c) during degradation of glycogen is broken by glycogenphosphorylase
d) during degradation of glycogen is broken into free glucose

153. Activity glycogensynthase in the liver decreases:
a) mainly hormone glucagon
b) hormone formed by β-cells of Langerhans islets
c) hormone which in its mechanism of action increases level of cAMP
d) hormone which is secreted in low glucose concentration in blood

154. Activity of glycogensynthase in liver increases:
    a) hormone of β-cells of Langerhans islets
    b) hormone which causes dephosphorylation of glycogensynthase
    c) hormone which is secreted during starvation and by phosphorylation changes enzyme into active form
    d) hormoe which is directly transported into liver cell

155. Glycogenphosphorylase is the enzyme which:
    a) causes hydrolysis of glycogen
    b) breaks α-1,4 glycosidic bond
    c) produces glucose-1-phosphate
    d) in muscle is activated by glucagon

156. Glycogenphosphorylase catalyzes:
    a) synthesis of glucose-1-phosphate
    b) reaction which requires H_3PO_4
    c) spliting of α-1,4-glycosidic bond
    d) reversible reaction

157. Glucose-1-phosphate:
    a) is product of glycogenphosphorylase
    b) is formed by spliting of α-1,6-glycosidic bond
    c) is intermediate of glycogen synthesis
    d) is intermediate of glycogen degradation

158. Glucose-6-phosphate:
    a) is intermediate of glycogen synthesis
    b) in glycogen degradation is formed by phosphoglucomutase
    c) is formed by degradation of α-1,6-glycosidic bond
    d) is final product of glycogen degradation in skeletal muscles

159. Free glucose during glycogen degradation can be formed:
    a) by hydrolysis of α-1,4-glycosidic bond
    b) by glycogenphosphorylase
    c) by debranching enzyme
    d) in both liver and skeletal muscle

160. Activation of glycogenphosphorylase mediates:
    a) ATP by activation of proteinkinase
    b) cAMP
    c) compound which is formed by cytosolic enzyme
    d) compound which is inactivated by adenylcyclase

161. Regulatory enzymes of glycogen metabolism:
    a) are glycogensynthase and glycogenphosphorylase
    b) are regulated by covalent modification
    c) both are active in dephosphorylated form
    d) are enzymes phosphorylation of which is activated by cAMP

162. Glycogensynthase and glycogen phosphorylase are enzymes which:
    a) are regulated by phosphorylation and dephosphorylation
    b) are phosphorylated in presence of cAMP
    c) both are activated during starvation

d) both participate in regulation of glycogen degradation and glycolysis

163. Glycogensynthasephosphorylasekinase (GSPK) is enzyme which:
a) is active in dephosphorylated form
b) is responsible for phosphorylation of glycogensynthase and glycogenphosphorylase
c) in presence of cAMP is in active phosphorylated form
d) causes phosphorylation of glycogenphosphorylase and by this way activation of glycogen degradation

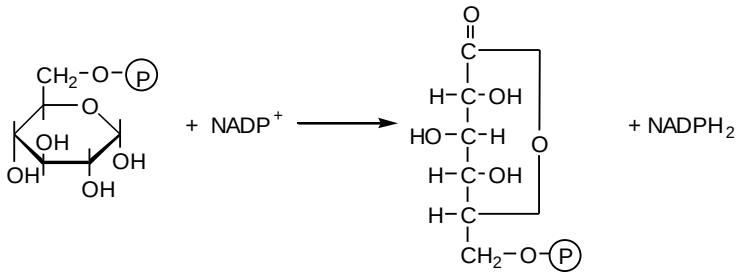
164. Comparing glycogen degradation in liver and in skeletal muscles we can say:
a) final product of glycogen degradation in muscles is glucose-6-phosphate
b) degradation of glycogen in liver is activated by glucagon
c) degradation of glycogen in muscles is activated by Ca^{2+} ions
d) degradation of glycogen in both – liver and skeletal muscles can increase glucose level in blood

165. Pentose phosphate pathway:
a) is important for ATP synthesis
b) proceeds in cytosol
c) is required for ribosephosphate synthesis
d) is required for synthesis of $NADPH_2$

166. In pentose phosphate pathway:
a) glucose is reduced
b) pentoses like deoxyribose are formed
c) $NADPH_2$ is formed in reaction of glucose-6-phosphate synthesis
d) $NADPH_2$ is formed in reaction of glucose-6-phosphate conversion

167. Ribose-5-phosphate is compound which:
a) is formed in pentose phosphate pathway
b) is formed in every metabolic process of glucose oxidation
c) is formed in the process located in cytosol
d) requires NAD for its synthesis

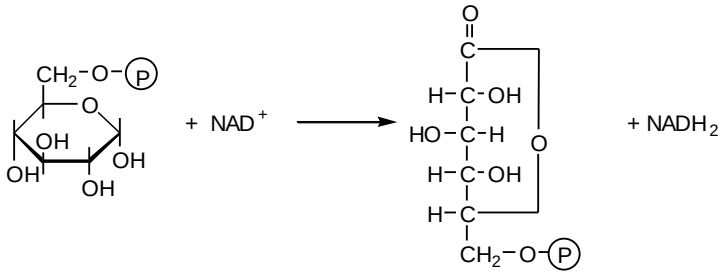
168. Reaction:



a) is located in cytosol
b) is catalyzed by lactonase
c) is important for energy metabolism
d) is reaction of metabolic pathway where glucose is changed to pentoses

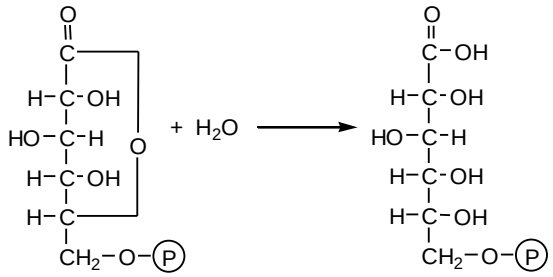
169. Glucose-6-phosphate dehydrogenase:

a) catalyzes reaction:



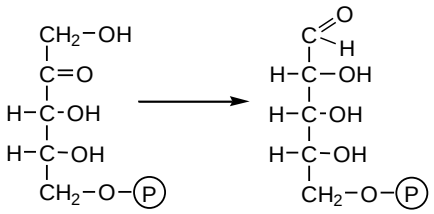
b) is cytosolic enzyme
c) contains as coenzyme derivative of B_2 vitamin
d) leads to synthesis of coenzyme required for fatty acid synthesis

170. Reaction:



a) is catalyzed by lactonase
b) belongs to hydrolytic reactions
c) leds to synthesis of 6-phosphogluconate
d) is reaction of the cycle which is important for synthesis of $NADPH_2$

171. Reaction:



a) is located in cytosol
b) is reaction of glucose oxidation by glycolysis
c) is catalyzed by epimerase
d) is catalyzed by isomerase

172. Thiaminepyrophosphate in pentose phosphate patway is required for:
a) glucose-6-phosphate dehydrogenase
b) synthesis of ribose-5-phosphate
c) transketolase
d) reaction in which sedoheptulose-7-phosphate is formed

173. $NADPH+H^+$:
a) is formed by 6-phosphogluconate dehydrogenase
b) is during synthesis of 6-phosphogluconate
c) is important coenzyme for synthesis of cholesterol
d) is important coenzyme for oxidation of fatty acids

174. Conversion of glucose-6-phosphate to 6-phosphogluconate:
    a) is reaction of glycolysis
    b) requires $NADPH_2$
    c) is important for enetgy metabolism
    d) allows production of coenzyme required for fatty acids synthesis

175. Glucose-6-phosphate dehydrogenase:
    a) catalyzes synthesis of 6-phosphogluconate
    b) catalyzes reaction of pentose phosphate pathway
    c) is source of hydrogens for terminal oxidation
    d) uses as coenzyme NADP

176. Reaction of conversion of 6-phosphogluconate in pentose phosphate pathway:
    a) is catalyzed by 6-phosphogluconate isomerase
    b) requires NAD as coenzyme
    c) leads to synthesis of ribulose-5-phosphate
    d) allows synthesis of coenzyme which is required for fatty acid synthesis

177. Reaction of pentose phosphate pathway in which ribulose-5-phosphate is formed:
    a) is catalyzed by glucose-6-phosphate dehydrogenase
    b) proceeds in mitochondria
    c) uses NADP as coenzyme
    d) uses 6-phosphogluconate as substrate

178. Increased production of ketone bodies in diabetes is caused by:
    a) increased activity of Krebs cycle
    b) increased concentration of lactate in blood
    c) increased concetration of cortisol
    d) increased oxidation of lipids

179. Which of following hormones participate in regulation of blood glucose:
    a) adrenaline that increases glucose level
    b) all hormones of adrenal cortex
    c) insulin that decreases glucose level
    d) glucocorticoids that increase glucose level

180. Glucocorticoids are hormones which:
    a) are secreted from pancreas
    b) increase degradation of glycogen
    c) decrease rate of glycolysis
    d) increase level of cAMP

181. Insulin is the hormone which:
    a) decreases activity of pyruvate kinase
    b) increases rate of glycolysis
    c) activates synthesis of fatty acids
    d) stimulates gluconeogenesis

182. Epinephrine (adrenaline) is the hormone which:
    a) is secreted from adrenal cortex
    b) activates gluconeogenesis in liver
    c) activates glycogenolysis in skeletal muscle
    d) causes decrease of cAMP

183. In regulation of blood glucose level participate:
    a) thyroid hormone
    b) calcitonine
    c) glucagon
    d) hormone secreted during stress

184. Insulin:
    a) is secreted from α-cells
    b) is secreted if blood glucose level is decreased
    c) is required for glucose transport into the cells
    d) decreases glucose oxidation in cells

185. When level of glucose in blood increases:
    a) glucagon is secreted
    b) fatty acids from adipose tissue are released
    c) glycogen in liver is broken
    d) gluconeogenesis is inhibited by insulin

186. Insulin decreases blood glucose level by:
    a) stimulation of gluconeogenesis
    b) activation of glucose conversion into fatty acids
    c) stimulation of glucose transport into the cells
    d) activation of fatty acid degradation in adipose tissue

187. Insulin participates in regulation of blood glucose level by:
    a) increased glucose transport into the cells
    b) activation of glycogen synthesis
    c) inhibition of fatty acid synthesis
    d) inhibition of gluconeogenesis

188. Glucocorticoids:
    a) are hormones formed in adrenal medulla
    b) increase level of cAMP
    c) increase synthesis of gluconeogenetic enzymes
    d) stimulate degradation of proteins in extrahepatic tissues

189. Glucagon is the hormone which:
    a) is secreted when plasma glucose level is low
    b) increases plasma membrane permeability for glucose
    c) activates gluconeogenesis
    d) activates synthesis of fatty acids from glucose

190. Increased glucose concetration in blood causes:
    a) increased osmolarity of blood
    b) decrease of pH – acidosis
    c) glycosuria
    d) decreased insulin secretion

191. Acetyl-CoA is compound which:
    a) is formed mainly from amino acids
    b) can be formed form glucose
    c) is formed only in cytosol
    d) cannot be used for gluconeogensis

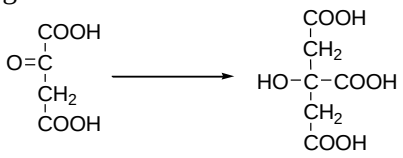
192. Which offollowing statements about acetyl-CoA is correct:

a) acetyl-CoA from glucose is formed in cytosol
b) synthesis of acetyl-CoA from pyruvate requires thiaminepyrophosphate
c) synthesis of acetyl-CoA from pyruvate is irreversible reaction
d) utilization of acetyl-CoA is possible only in mitochondria

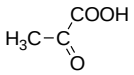
193. Acetyl-CoA can be used:
a) for synthesis of ATP in mitochondria
b) for synthesis of fatty acids in cytosol
c) for synthesis of ketone bodies in cytosol
d) for synthesis of cholesterol in mitochondria

194. Acetyl-CoA:
a) can be oxidized in mitochondria and cytosol
b) for synthesis of fatty acids is used in cytosol
c) can be formed by pyruvate dehydrogenase
d) can be changed into ketone bodies

195. Conversion:



a) requires this compound as substrate



b) is catalyzed by transaminase
c) is inhibited by ATP
d) proceeds in mitochondria

196. Citrate synthase:
a) is located in inner mitochondial membrane
b) is located in cytosol
c) catalyzes condensation of acetyl-CoA and citrate
d) produces compound which is utilized in mitochondria only

197. Citrate synthase catalyzes reaction which:
a) proceeds in mitochondrial matrix
b) uses as substrate acetyl-CoA
c) is activated by ATP
d) produces compound which can be used for synthesis of fatty acids

198. Which of statements about regulatory role of citrate synthase in Krebs cycle are correct:
a) it is the most important regulatory enzyme of Krebs cycle
b) enzyme is inhibited by citrate
c) main regulator of citrate synthase is insulin
d) enzyme is inhibited by ATP and NADH+H^+

199. Citrate synthase in regulation of Krebs cycle:
a) is activated by citrate
b) is inhibited by ATP and NAD
c) is activated by ATP
d) is not influenced by hormones

200. Aconitase is enzyme which:
a) is responsible for conversion of citrate to isocitrate
b) uses NAD as coenzyme
c) is important regulatory enzyme of Krebs cycle

d) catalyzes reversible reaction

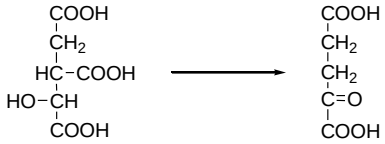
201. Reaction catalyzed by aconitase:
   a) allows conversion of citrate to isocitrate
   b) as substrate uses citrate
   c) leads to synthesis of compound for conversion of which NAD is required
   d) is located in outer mitochondrial membrane

202. Isomere of citrate in Krebs cycle in formed in reaction which:
   a) is catalyzed by citrate synthase
   b) is catalyzed by citrate isomerase
   c) is catalyzed by acinitase
   d) does not require any coenzyme

203. Reaction catalyzed by isocitrate dehydrogenase:
   a) can proceed in both mitochondria and cytosol
   b) proceeds only in aerobic conditions
   c) uses NAD^+ as coenzyme
   d) is inhibited by ADP and $NADH_2$

204. Isocitrate dehydrogenase is enzyme which:
   a) is present only in mitochondria
   b) is key regulatory enzyme of Krebs cycle
   c) catalyzes synthesis of isocitrate
   d) allows synthesis of 3 ATP by oxidative phosphorylation

205. Reaction of conversion of isocitrate in Krebs cycle:
   a) is catalyzed by isocitrate dehydrogenase
   b) requires FAD as coenzyme
   c) is activated by ATP
   d) allows synthesis of ATP by phosdphorylation at the substrate level

206. Conversion 

   a) is catalyzed by ketoglutarate dehydrogenase
   b) requires NAD as coenzyme
   c) proceeds in mitochondria and cytosol
   d) allows synthesis of 3 ATP by oxidative phosphorylation

207. α-ketoglutarate in Krebs cycle is formed:
   a) by action of isocitrate dehydrogenase
   b) by the action of aconitase
   c) by reaction which requires thiaminepyrophosphate
   d) in reaction which is key regulatory step of Krebs cycle

208. α-ketoglutarate dehydrogenase:
   a) is enzyme of Krebs cycle which catalyzes reversible reaction
   b) requires 5 coenzymes
   c) is responsible for synthesis of compound with thioester energy rich bond
   d) is enzyme coenzyme of which allows synthesis of 4 ATP

209. α-ketoglutarate dehydrogenase:

a) catalyzes oxidative decarboxylation of α-ketoglutarate
b) catalyzes synthesis of compound with thioester energy rich bond
c) enables synthesis of 2 ATP in respiratory chain
d) requires thiamine pyrophosphate and lipoate as coenzymes

210. Enzyme which catalyzes convesrion of α-ketoglutarate to succinyl-CoA:
a) is α-ketoglutarate dehydrogenase
b) is key regulatory enzyme of Krebs cycle
c) requires coenzymes thiaminepyrophosphate, lipoate, CoA, NAD and FAD
d) produces compound which can be used for synthesis of ATP by substrate level phosphorylation

211. Succinyl-CoA:
a) is formed in reaction which reauires thiaminepyrophosphate, lipoate, CoA, NAD and FAD
b) contains energy rich thioester bond
c) can be used for ATP synthesis by substrate level phosphorylation also in anaerobic conditions
d) is important for utilization of ketone bodies

212. Conversion of succinyl-CoA to succinate in Krebs cycle:
a) is reaction where by substrate level phosphorylation GTP is formed
b) is catalyzed by succinate dehydrogenase
c) allows synthesis of ATP only in aerobic conditions
d) requires thiaminepyrophosphate as coenzyme

213. Substrate level phosphorylation in Krebs cycle:
a) is reaction of conversion of succinyl-CoA to succinate
b) is catalyzed by succinylthiokinase
c) uses energy of thioester energy rich bond for synthesis of GTP
d) as it is substrate level phosphorylation proceeds also in anaerobic conditions

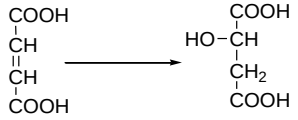
214. Reaction of substrate level phosphorylation in Krebs cycle:
a) changes succinate to succinyl-CoA
b) produces GTP by the enzyme thiokinase
c) requires enzyme succinylthiokinase
d) produces compound which is source of energy in proteosynthesis

215. Further conversion of succinate in Krebs cycle:
a) requires FAD as coenzyme
b) leads to synthesis of fumarate
c) allows synthesis of 4 ATP by oxidative phosphorylation
d) is possible only in aerobic conditions

216. Succinate dehydrogenase in Krebs cycle:
a) is responsible for conversion of succinyl-CoA
b) uses as substrate product of succinylthiokonase
c) uses as coenzyme compound derived form vitamin B_2
d) uses as coenzyme compound which allows synthesis of 2 ATP by oxidative phosphorylatiion

217. Conversion of fumarate in Krebs cycle:
a) leads to synzhesis of unsaturated dicarboxylic acid
b) requires NAD as coenzyme
c) is performed by adition of water
d) is catalyzed by malic enzyme

218. Fumarase is enzyme which:
   a) uses as substrate trans-isomere of unsatuated dicarboxylic acid
   b) uses as substrate compound which is product of succinylthiokinase
   c) catalyzes reaction in which ATP is not formed
   d) leads to synthesis of malate

219. Conversion 

   a) is catalyzed by malate dehydrogenase
   b) is located in mitochondria
   c) requires NAD as coenzyme
   d) is hydrogenation

220. Malate dehydrogenase is the enzyme which:
   a) catalyzes reaction important only for Krebs cycle
   b) uses as coenzyme NAD
   c) allows synthesis of 3 ATP by reoxidation of its coenzyme in terminal oxidation
   d) uses product of fumarase as substrate

221. Reaction cataylzed by malatedehydrogenase:
   a) proceeds in mitochondria and cytosol
   b) is component of the shuttle by which 3 ATP are formed in mitochondria
   c) can proceed also in anaerobic conditions
   d) proceeds in all cells of human body

222. Regulators of isocitrate dehydrogenase are:
   a) citrate which inhibits the enzyme
   b) ADP which activates the enzyme
   c) ATP and $NADH_2$ which inhibit the enzyme
   d) Glukagon which by phosphorylation inhibits the enzyme

223. Isocitrate dehydrogenase in regulation of Krebs cycle:
   a) represents key regulatory enzyme
   b) is activate by product of reaction – ketoglutarate
   c) is activated in good energy state
   d) is inhibited by ATP which causes change of the enzyme into inactive dimeric form

224. By oxidation of acetyl-CoA in Krebs cycle:
   a) ATP is formed only in aerobic conditions
   b) CO_2 is formed in reaction of ketoglutarate synthesis
   c) reoxidation of $NADH_2$ allows synthesis of 9 ATP
   d) 2 ATP can be formed in reaction of fumarate synthesis

225. Oxidation of acetyl-CoA in Krebs cycle:
   a) allows synthesis of 2 ATP by substrate level phsohprylation
   b) leads to synthesis of $FADH_2$ in reaction catalyzed by fumarase
   c) allows synthesis of 11 ATO by oxidative phosphorylation
   d) leds to synthesis of 3 $NADH_2$

226. Reaction of substrate level phosphorylation in Krebs cycle:
   a) uses succinate as coenzyme
   b) uses as substrate compound with energy rich thioester bond
   c) proceeds in mitochondria only

d) is catalyzed by isocitrate dehydrogenase

227. Reaction of Krebs cycle where substrate level phosphorylation occurs:
   a) proceeds in cytosol
   b) leads to synthesis of GTP
   c) uses as substrate compound which can be formed from amino acids – methionine, valine and isoleucine
   d) proceeds only in aerobic conditions

228. Reoxidation of reduced coenzymes formed in Krebs cycle allows synthesis of:
   a) 12 ATP by oxidative phosphorylation
   b) 2 ATP from coenzym formed by succinate dehydrogenase
   c) 3 ATP from coenzyme of isocitrate dehydrogenase
   d) 1 ATP duringh convesrion of oxaloacetate to citrate

229. $NADH+H^+$ in Krebs cycle is formed:
   a) in three reactions
   b) in reaction of succinyl-CoA synthesis
   c) in reaction of succinyl-CoA conversion
   d) in reaction of isocitrate conversion

230. Coenzyme by oxidation of which 3 ATP can be formed in Krebs cycle is formed:
   a) in reaction of isocitrate synthesis
   b) in reaction of succinate conversion
   c) in four reactions
   d) in reaction of oxaloacetate synthesis

231. Coenzyme by oxidation of which 2 ATP can be formed in Krebs cycle is synthesized:
   a) in reaction of ketoglutarate convesrion
   b) in reaction of succinate synthesis
   c) in reaction of fumarate synthesis
   d) in reaction of succinate conversion

232. Enzymes of Krebs cycle:
   a) are part of outer mitochondrial membrane
   b) are responsible for synthesis of acetyl-CoA
   c) are required only for ATP synthesis
   d) in anaerobic conditions they cannot act

233. Enzyme complex required for conversion of pyruvate to acetyl-CoA:
   a) is located in cytosol
   b) allows synthesis of 3 ATP
   c) is present in all cells of human body
   d) is required for utilization of pyruvate in gluconeogenesis

234. Conversion of pyruvate into acetyl-CoA:
   a) is catalyzed by pyruvate dehydrogenase
   b) is catalyzed by enzyme which consists of three subunits
   c) requires 5 coenzymes including biotin
   d) is irreversible reaction

235. Pyruvate dehydrogenase catalyzes reaction which:
   a) proceeds in mitochondria
   b) is required for complete oxidation of glucose
   c) allows conversion of glucose into fatty acids

d) requires thiaminepyrophosphate as one of the coenzymes

236. Lipoic acid in pyruvate dehydrogenase complex:
a) directly participates in decarboxylation of pyruvate
b) participates in oxidation of acetaldehyde
c) is reduced
d) is oxidized by transfer of hydrogens to NAD

237. Compound required for utilization of ketone bodies in extrahepatic tissues:
a) is formed in glycolysis
b) is formed by isocitrate dehydrogenase
c) is compound with thioester energy rich bond
d) is palmitoyl-CoA

238. In regulation of Krebs cycle participates:
a) ATP which activates citrate synthase
b) ATP and $NADH_2$ which inhibit isocitrate dehydrogenase
c) glucagon which inhibits all enzymes of Krebs cycle
d) ADP which changes isocitrate dehydrogenase into active ocamer

239. Citrate synthase and isocitrate dehydrogenase are enzymes which:
a) belong to regulatory enzymes of Krebs cycle
b) are located in mitochondria
c) are regulated by ratio ATP/ADP
d) are regulated by energy state of the cell

240. High concentrations of ATP:
a) inhibit all enzymes of Krebs cycle
b) inhibit phosphofructokinase I in glycolysis
c) inhibit isocitrate dehydrogenase in Krebs cycle
d) activate glucokinase in glycolysis

241. Cerebrosides:
a) contain sphingosine as alcoholic component
b) contain fatty acid bound by –CO–NH– bond
c) contain carbohydrate bound to alcohol by ester bond
d) contain ologosaccharide

242. Cerebrosides contain in their structure:
a) the same alcohol as lecithines
b) fatty acid boun by bond –O–CO–
c) pentoses
d) carbohydrate bound to $-NH_2$ goup of sphingosine

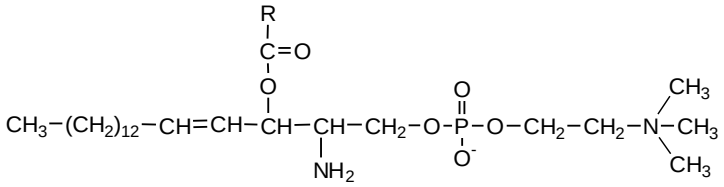
243. Ceramide is compound which:
a) belong to phospholipids
b) is basic component of acylglycerols
c) contains fatty acid bound by peptide bond
d) is component of glycolipids

244. Lipids with carbohydrate component:
a) are phospholipids
b) contain ceramide
c) contain fatty acid bound by peptide bond
d) are for example cerebrosides and lecithines

245. Sphingosine:
   a) is alcohol present in all phospholipids
   b) is unsaturated C_{18} aminoalcohol
   c) is alcoholic component of acylglycerols
   d) contain -NH_2 group to which fatty acid is bound

246. C_{18} unsaturated aminoalcohol:
   a) is inositol
   b) is component of sphingomyelins
   c) is component of gangliosides
   d) is alcoholic component of lipids in adipose tissue

247. Compound:



   a) is sphingomyelin
   b) belongs to phospholipids
   c) is main component of adipose tissue
   d) does not exist

248. Sphingomyelins are lipids which:
   a) belong to phospholipids
   b) are present in nervous tissue
   c) contain two phosphate residues bound to -OH groups of sphingosine
   d) contain choline as non-lipidic component

249. Phosphatidylinositols contain in their molecula:
   a) two fatty acids
   b) phosphate bound to 1^{st} or 2^{nd} carbon
   c) cyclic alcohol inositol
   d) choline

250. Lecithines:
   a) contain two fatty acids bond to -OH groups of glycerol
   b) contain serine as non-lipidic component
   c) contain polar and non-polar part in their molecules
   d) are important component of plasma membranes

251. Fatty acid in sphingomyelins is bound:
   a) to phosphate
   b) by –CO–NH– bond
   c) by the same bond as fatty acids are bound in acylglycerols
   d) by the bond which is present for example in glugagon

252. Alcoholic component of cerebrosides:
   a) is sphingosine
   b) is formed form palmitoyl-CoA and serine
   c) binds fatty acid to its -OH group
   d) is glycerol

253. During activation of palmitic acid:

a) palmitoyl-CoA and ATP are substrate
b) as intermediate acyladenylate is formed
c) two energy rich bonds are spent
d) enzyme present in inner mitochondrial membrane is required

254. Activation of fatty acids:
a) is required for synthesis of fatty acids
b) is catalyzed by acyl-CoA synthase
c) requires GTP as source of energy
d) uses ATP as source of energy and after activation of fatty acid ADP is released

255. Activation of fatty acids can be catalyzed by:
a) enzyme system which uses ATP as source of energy
b) fatty acid synthase
c) acyl-CoA synthase
d) CoA transferase in case of short chain fatty acids

256. During activation of fatty acids before β-oxidation:
a) ATP is broken into ADP
b) compound with acylphosphate energy rich bond is formed as intermediate
c) fatty acid is changed to acyl-CoA
d) two ebergy rich bonds are spent

257. Activated fatty acids are transported into mitochondria by help of:
a) CoA
b) ATP
c) active transport
d) compound to which fatty acid is bound by ester bond

258. For transport of activated fatty acid into mitochondria is required compound which:
a) contains -OH group
b) contains -CH_3 groups
c) cannot be synthesized in human body
d) binds fatty acid by help of carnitine acyltransferase I

259. Carnitine is compound which:
a) is peptide required for transport of fatty acids
b) is required for tranport of fatty acids in blood
c) is synthesized form two essential amino acids
d) binds fatty acid by peptide bond

260. Carnitineacyltransferase I:
a) is located in cytosol
b) uses carnitine and fatty acid as substrates
c) catalyzes transport of carnitine into mitochondria
d) is activated by malonyl-CoA

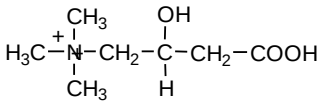
261. Carnitineacyltransferase I is enzyme which:
a) is present in outer side of inner mitochondrial membrane
b) uses acyl-CoA and carnitine as substrates
c) catalyzes transfer of fatty acid residue to -COOH group of carnitine
d) is inhibited by malonyl-CoA

262. Carnitineacyltransferase II is enzyme which:
a) is located in mitochondrial matrix

b) catalyzes transfer of fatty acid residue form acylcarnitine to CoA
c) participates in transport of activated fatty acid into mitochondria
d) requires ATP for its activity

263. Trnaport of activated fatty acids into place of β-oxidation:
a) is not important because fatty acid are activated in mitochondria
b) requires NAD as coenzyme
c) requires carnitine
d) is inhibited by malonyl-CoA

264. Activated fatty acid is transported into mitochondria by:
a) active transport
b) help of citrate
c) CoA
d) system which requires carnitineacyltransferase I and carnitineacyltransferase II

265. Compound: 

a) is carnitine
b) requires methionine for its synthesis
c) is required for transport of activated fatty acids for mitochondria into cytosol
d) by reaction with acyl-CoA gives acylcarnitine

266. Reaction of β-oxidation which allows synthesis of 2 ATP by oxidative phosphorylation:
a) is reaction of conversion of acyl-CoA to enoyl-CoA
b) uses coenzyxme derived form vitamion B_2
c) is catalyzed by enoyl-CoA hydratase
d) is reaction in which substrate fopr ketothiolase is formed

267. Adition of water in β-oxidation:
a) leads to synthesis of β-hydroxyacyl-CoA
b) is catalyzed by enoyl-CoA hydratase
c) uses product of acyl-CoA dehydrogenase as substrate
d) allows synthesis of 3 ATP by oxidative phosphorylation

268. Reaction of β-oxidation which allows synthesis of 3 ATP by oxidative phosphorylation is:
a) reaction of enoyl-CoA synthesis
b) reaction of enoyl-CoA conversion
c) reaction of convesrion of product of enoyl-CoA hydratase
d) reaction which leads to synthesis of β-ketoacyl-CoA

269. Synthesis of 3 ATP from coenzyme formed in β-oxidation allows:
a) reaction catalyzed by acyl-CoA dehydrogenase
b) reaction of conversion of enoyl-CoA to β-hydroxyacyl-CoA
c) reaction of β-keto-acyl-CoA synthesis
d) of enoyl-CoA synthesis

270. Dehydrogenation reactions in β-oxidation are catalyzed by:
a) acyl-CoA dehydrogenase with FAD as coenzyme
b) enzyme which produces enoyl-CoA
c) enoly-CoA hydratase
d) β-hydroxyacyl-CoA dehydrogenase with NAD as coenzyme

271. During oxidation of palmitic acid in β-oxidation:
    a) cycle of β-oxidation proceeds 7 times
    b) 7 $NADH+H^+$, 7 $FADH_2$ and 8 acetyl-CoA are formed
    c) by oxidation of acetyl-CoA formed in β-oxidation 88 ATP are formed
    d) ATP is formed in mitochondria

272. During complete degradation of palmotoyl-CoA in β-oxidation are formed:
    a) 96ATP by oxidation of acetyl-CoA in Krebs cycle
    b) 21 ATP from coenzyme of acyl-CoA dehydrogenase
    c) 14 ATP in reaction of acetyl-CoA synthesis
    d) 21 ATP form coenzyme of β-ketoacylthiolase

273. During β-oxidation of fatty acids with odd number of carbons as the last product is formed:
    a) propionyl-CoA
    b) malonyl-CoA
    c) compound for conversion of which vitamin B_{12} is required
    d) compound which is changed to succinyl-CoA

274. During oxidation of stearic acid in β-oxidation:
    a) 9 acetyl-CoA are formed
    b) cycle of β-oxidation proceeds 9 times
    c) by reoxidation of coenzymes formed in β-oxidation 35 ATP are formed
    d) comúpound which can be used for gluconeogenesis is formed

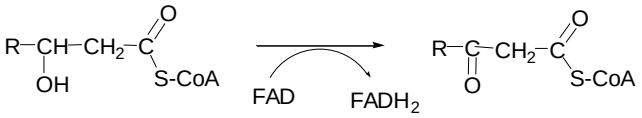
275. Complete oxidation of stearic acid allows:
    a) synthesis of 146 ATP
    b) synthesis of 129 ATP
    c) synthzesis of 40 ATP vy reoxidation of coenzymes formed in β-oxidation
    d) synthesis of less ATP than oxidation of myristic acid

276. Process of oxidation of myristic acid:
    a) produces 7 $NADH_2$ and 7 $FADH_2$
    b) leads to synthesis of 7 acetyl-CoA
    c) allows synthesis of 112 ATP
    d) for activation of myristic acid requires 1 energy rich bond

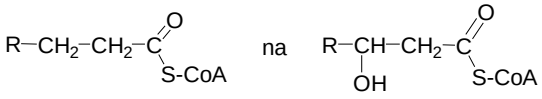
277. Acetyl-CoA in β-oxidation is formed:
    a) from substrate acyl-CoA
    b) in reaction which uses NAD as coenzyme
    c) form substrate wghich is product of enoyl-CoA hydratase
    d) in reaction which uses water as one of substrates

278. Synthesis of acetyl-CoA in β-oxidation:
    a) is catalyzed by β-ketothiolase
    b) requires CoA as one of substrates of reaction
    c) requires β-hydroxyacyl-CoA as substrate
    d) can proceed only in aerobic conditions

279. Acyl-CoA dehydrogenase:
    a) catalyzes reaction

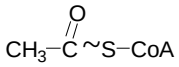


b) uses as coenzyme FAD
c) catalyzes conversion of

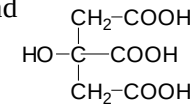


d) catalyzes reaction which allows synthesis of 3 ATP

280. Compound:

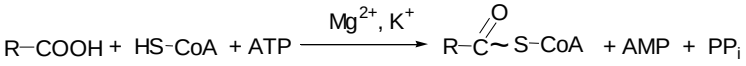


a) by oxidation in Krebs cycle allows synthesis of 12 ATP
b) during β-oxidation of product of β-ketoacylthiolase
c) for fatty acids synthesis is transported from mitochondria into cytosol in the form of compound



d) is substrate for ketone bodies synthesis

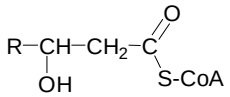
281. Reaction:



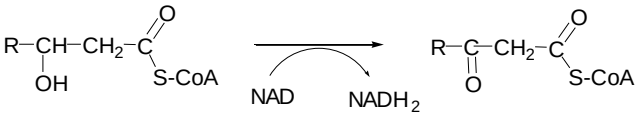
a) is reaction of fatty acid activation
b) proceeds in inner mitochondrial membrane
c) requires energy of one energy rich bond
d) leds to synthesis of product which is transported into mitochondria by help of carnitine

282. Enoyl-CoA hydratase:

a) catalyzes reaction of conversion of enoyl-CoA into



b) leads to synthesis of product which is changed by reaction



c) uses FAD as coenzyme
d) uses as substrate product of acyl-CoA dehydrogenase

283. β-oxidation of fatty acids:
a) is important source of energy in myocardium
b) proceeds also in anaerobic conditions
c) requires reduced form of NAD
d) is activated by insulin

284. β-oxidation of fatty acids:
a) requires aerobic conditions

b) is located in endoplasmic reticulum
c) is main source of energy for brain
d) requires reoxidation of reduced coenzymes in terminal oxidation

285. Acetyl-CoA in synthesis of fatty acids is formed in cytosol:
a) from acylcarnitine
b) from palmitate
c) from citrate
d) from compound which is formed in mitochondria

286. Acetyl-Co required for fatty acids synthesis is formed:
a) in cytosol by pyruvate dehydrogenase
b) in mitochondria from where is transported into cytosol in the form of citrate
c) in cytosol by the enzyme ATP-citrate lyase
d) in cytosol by the process of β-oxidation

287. Citrate synthase and ATP-citrate lyase are enzymes which:
a) both are required for fatty acid synthesis
b) both are present in mitochondria
c) both are present in cytosol
d) both are activated by ATP

288. ATP citrate lyase and citrate synthase are enzymes which:
a) participate in oxidation of fatty acids
b) are required for transport of acetyl-CoA form mitochondria into cytosol
c) are required for transport of fatty acids into mitochondria
d) are inhibited by ATP

289. Carboxylation of acetyl-CoA to malonyl-CoA:
a) uses substrates acetyl-CoA and CO_2
b) uses pyridoxalphosphate as coenzyme
c) proceeds in mitochondria
d) is catalyzed by enzyme which is active in dephosphorylated form

290. Synthesis of malonyl-CoA in synthesis of fatty acids:
a) proceeds in cytosol
b) is regulatory step in fatty acids synthesis
c) is catalyzed by acetyl-CoA carboxylase
d) is activated by glucagon during starvation

291. β-hydroxyacyl-ACP in fatty acid synthesis is formed:
a) from acetyl-CoA and malonyl-CoA as substrates
b) form β-ketoacyl-ACP by oxidation
c) by the action of condensing enzyme
d) by addition of water

292. Synthesis of β-hydroxyacyl-ACP requires:
a) substrate β-ketoacyl-ACP
b) coenzyme formed in pentose phosphate pathway
c) coenzyme $FADH_2$
d) β-ketoacylreductase

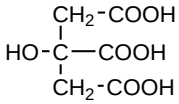
293. Regulatory step in fatty acid synthesis is:
a) reaction which requires biotine

b) reaction in which methylmalonyl-CoA is formed
c) reaction where acetyl-CoA is carboxylated
d) reaction which is catalyzed by citrate synthase

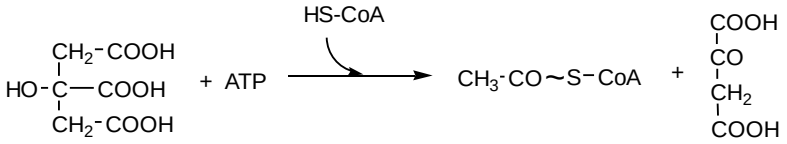
294. Enzyme which plays key role in regulation of fatty acid synthesis is:
a) acetyl-CoA carboxylase
b) enzyme which requires ATP
c) enzyme by action of which malonyl-CoA is formed
d) enzyme which is activated during starvation

295. Reaction: $CH_3-CO\sim S-CoA + HCO_3^- + ATP \longrightarrow HOOC-CH_2-CO\sim S-CoA + ADP + P_i$

a) is the first step in fatty acid synthesis
b) is catalyzed by acetyl-CoA carboxylase which is active in dephosphorylated form
c) uses thiamine as coenzyme
d) is activated by citrate

296. Synthesis of fatty acids:
a) proceeds in mitochondria
b) uses as substrate CH_3-CO~S-CoA which is formed by oxidative decarboxylation of pyruvate in cytosol
c) requires $NADH_2$
d) uses  for transport of CH_3-CO~SCoA from mitochondria into cytosol

297. Synthesis of fatty acids is the process about which we can say:
a) proceeds in cytosol
b) is activated by insulin
c) actetyl-CoA as substrate for fatty aci synthesis is formed in cytosol by reaction



d) reduced coenzymes required for fatty aci synthesis are formed mainly in glycolysis and Krebs cycle

298. Reaction of fatty acid synthesis:

$$CH_3-(CH_2)_{12}-CH=CH-CO\sim S-ACP + NADPH+H^+ \longrightarrow$$
$$\longrightarrow CH_3-(CH_2)_{14}-CO\sim S-ACP + NADP^+$$

a) uses coenzyme formed in pentose phosphate pathway
b) is catalyzes by enoyl-CoA hydratase
c) is reaction of mitoíchondrial elongation of fatty acids
d) is activated during starvation by glucagon

299. Malic enzyme is enzyme which:
a) is responsible for synthesis of malate
b) is responsible for convesrion of malate to pyruvate
c) is required for gluconeogenesis
d) is component of shuttle for transport of reducing equivalents into mitochondria

300. Malonyl-CoA is compound which:
   a) is formed form acetyl-CoA
   b) is formed by acetyl-CoA carboxylase
   c) is formed in reaction which requires biotine
   d) regulates of process of β-oxidation by activation of carnitineacyltransferase I

301. Acetyl-CoA carboxylase catalyzes reaction which:
   a) is responsible for acyl-CoA synthesis
   b) requires pyridoxalphosphate as coenzyme
   c) participates in fatty acid synthesis
   d) is activated by insulin

302. Reaction of malonyl-CoA synthesis:
   a) is regulatory step of fatty acid synthesis
   b) is activated by citrate
   c) requires biotin
   d) is inhibited by phosphorylation of enzyme in presence of glucagon

303. Acetyl-CoA carboxylase:
   a) participates in degradation of fatty acids
   b) is located in cytosol
   c) leads to synthesis of malonyl-CoA
   d) is inhibited by citrate

304. Acetyl-CoA carboxylase is enzyme which:
   a) participates in synthesis of fatty acids
   b) is inhibited by malonyl-CoA
   c) uses citrate as substrate
   d) is activated by phosphorylation in presence of insulin

305. Source of hydrogens for reduction reactions of fatty acid synthesis is:
   a) coenzyme containing nicotinamide
   b) coenzyme NAD
   c) coenzyme formed by malic enzyme
   d) coenzyme which is also donor of hydrogens for terminal oxidation

306. Condensing enzyme in fatty acid synthesis catalyzes reaction which:
   a) uses as substrates 2 mol of malonyl-CoA
   b) leads to synthesis of β-ketoacyl-ACP
   c) is main regulatory step of fatty acid synthesis
   d) is located in mitochondria

307. β-ketoacylreductase:
   a) is enzyme of fatty acid oxidation
   b) uses as coenzyme compound formed in cytosol
   c) is responsible for synthesis of enoyl-ACP
   d) is enzyme activated during starvation

308. β-hydroxyacyl-ACP is changed to enoyl-ACP:
   a) by dehydrataion
   b) by oxidation
   c) by reaction which requires water as substrate
   d) by reaction which requires $NADPH_2$ as coenzyme

309. Fatty acid synthase:
    a) is multienzyme complex located in cytosol
    b) consists of three catalytic subunits
    c) synthesizes fatty acids with nmaximal length 16 carbons
    d) is main regulatory enzyme of fatty aciod synthesis

310. Thioesterase is the enzyme which:
    a) is component of fatty acid synthase
    b) is component of multienzyme complex located in cytosol
    c) is responsible for cleavage of β-keto-acyl-CoA
    d) is enzyme of β-oxidation

311. Elongation of fatty acids:
    a) proceeds in cytosol
    b) proceeds in mitochondria and smooth endoplasmic reticulum
    c) is required because fatty acid synthase cannot synthesize fatty acids longer than 16 carbons
    d) uses $NADH_2$ and $FADH_2$ as coenzymes

312. Desaturation of fatty acids:
    a) can change stearic acid into oleic acid
    b) proceeds in mitochondria
    c) uses specific cytochrome – cyt b_5
    d) allows synthesis of essential fatty acids

313. $NADPH_2$ in the process of synthesis of fatty acids:
    a) is formed for example by glucose-6-phosphate dehydrogenase
    b) can be formed in cytosol by oxidation of isocitrate
    c) is required for condensing enzyme
    d) is required for conversion of enoyl-ACP into acyl-ACP

314. Which of following reactions can be source of $NADPH_2$ for synthesis of fatty acids:
    a) mitochondrial malate dehydrogenase
    b) cytosolic malic enzyme
    c) 6-phosphogluconate dehydrogenase
    d) HMG-CoA reductase

315. Fatty acid synthesis is regulated by:
    a) insulin which causes dephosphorylation of acetyl-CoA carboxylase and its inhibition
    b) insulin which causes dephosphorylation of acetyl-CoA carboxylase and its activation
    c) citrate which acts as direct activator of acetyl-CoA carboxylase
    d) glucagon which during starvation activates synthesis of fatty acids

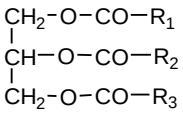
316. Which statements about role of hormones in regulation of fatty acid synthesis are correct:
    a) glucagon directly activates ATP-citrate lyase
    b) insulin causes dephosphorylation of acetyl-CoA carboxylase and thus its activation
    c) hormone secreted during starvation inhibits fatty acid synthesis by change acetyl-CoA carboxylase into inactive – phosphorylated form
    d) adrenaline causes phosphorylation of acetyl-CoA carboxylase and activates fatty acid synthesis during stress

317. Which statements about role of glucagon in regulation of fatty acids synthesis are correct:
    a) glucagon secreted during starvation stimulates transport of glucose into the cell and by this way inderectly activates fatty acid synthesis
    b) glucagon increases synthesis of cAMP and activates acetyl-CoA carboxylase by its phosphorylation

c) glucagon increases synthesis of cAMP and causes inhibition of acetyl-CoA carboxylase by its dephosphorylation
d) glucagon increases cAMP and activates ATP-citrate lyase by its phosphorylation

318. Which statements about regulation of fatty acid synthesis are correct:
a) citrate act as activator of acetyl-CoA carboxylase
b) adrenaline activates fatty acid synthesis
c) palmitoyl-CoA acts like inhibitor of acetyl-CoA carboxylase
d) main regulatory enzyme of fatty aciod synthesis – acetyl-CoA carboxylase is activated by insulin

319. Which of processes activated by insulin is important for conversion of glucose into fatty acids:
a) activation of hormone sensitive lipase
b) activation of acetyl-CoA
c) activation of glycolysis by increased synthesis of fructose-2,6-bisphosphate
d) activation of ATP-citrate lyase

320.  is compound which:

a) represents storage form of energy in liver
b) in lumen of intestine is broken by lipoprotein lipase
c) is formed in adipose tissue
d) in adipose tissue is hyrolyzed by hormone sensitive lipase

321. Which cells of human body synhesize and store triacylglycerols:
a) all cells without exception
b) liver cells
c) adipose tissue cells
d) enterocytes

322. For triacylglycerol synthesis in is used:
a) free glycerol
b) active form of glycerol – glycerolphosphate
c) CTP
d) activated fatty acids in the form of acylcarnitine

323. Alcoholic component of triacylglycerols in adipose tissue:
a) enters synthesis like free glycerol
b) enters synthesis like glycerol-phosphate
c) can be formed form free gylcerol by glycerolkinase
d) can be formed form intermediate of glycolysis dihydroxyacetone phosphate

324. In synthesis of triacylglycerols:
a) fatty acids in their active form – acyl-CoA are required
b) enzyme phosphatidate phosphatase is required
c) phosphatidic acid as intermediate is formed
d) source of alcoholic component in liver can be free glycerol

325. Hormone sensitive lipase is the enzyme which:
a) is responsible for hydrolysis of TAG from food
b) is responsible for hydrolysis of TAG in adipose tissue
c) is activated during stavation by glucagon
d) in presence of insulin is in inactive – phosphorylated form

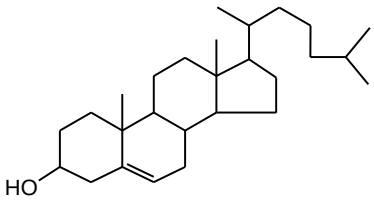
326. Degradation of triacylglycerols in adipose tissue:
   a) is catalyzed by lipoprotein lipase
   b) is catalyzed by enzyme which cleaves TAG into fatty acids and glycerol
   c) is inhibited by insulin which changes hormonesensitive lipase into inactive – dephosphorylated form
   d) is activated during stress by adrenalin which changes hormone sensitive lipase into active – phosphorylated form

327. In synthesis of lecithins:
   a) non-lipidic component – choline is formed form serine
   b) choline is activated by choline kinase
   c) CTP is required as source of energy
   d) CDP-choline is formed as intermediate

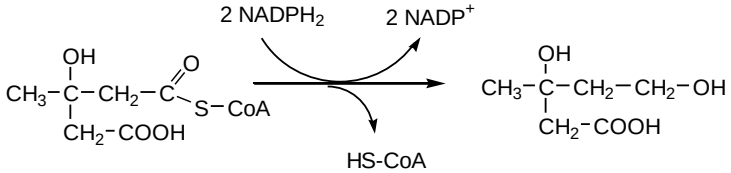
328. CDP-diacylglycerol is compound which:
   a) is intermediate of synthesis of glycolipids
   b) is formed form phosphatidic acid and CTP
   c) by reaction with inositol gives phosphatidylinositols
   d) contains phosphoanhydride energy rich bond

329. Synthesis of cholesterol in human body:
   a) is not important because cholesterol in taken by food
   b) proceeds in cytosol
   c) uses malonyl-CoA as substrate
   d) is activated by glucagon during starvation

330. In the process of cholesterol synthesis:
   a) acetoacetyl-CoA is formed as intermediate
   b) by action of HMG-CoA reductase mevalonate is formed
   c) reduced coenzyme formed in Krebs cycle is required
   d) ATP is required as source of energy

331.  is compound which:

   a) is precursor of biologically important coompounds (bile acids, vitamin D, steroid hormones)
   b) is synthesized in the process part of which is the reaction



   c) is synthesized in cytosol from acetyl-CoA
   d) requires $NADPH_2$ in the process of synthesis

332. HMG-CoA during cholesterol synthesis is changed:
   a) to mevalonate
   b) by HMG-CoA reductase
   c) by enzyme present in cytosol

d) by enzyme which is active in dephosphorylated form

333. Mevalonic acid is compound which:
   a) contains two -COOH groups
   b) is formed by oxidation of HMG-CoA
   c) is formed by reaction which uses $NADPH_2$ as coenzyme
   d) is formed in reaction which is key regulatory step of cholesterol synthesis

334. Mevalonic acid in cholesterol synthesis:
   a) is formed from immediate precursor acetoacetyl-CoA
   b) is called also active isoprene
   c) is formed in cytosol
   d) is formed by HMG-CoA reductase

335. HMG-CoA reductase is enzyxme which:
   a) is responsible for synthesis of HMG-CoA
   b) catalyzes decarboxylation of HMG-CoA
   c) is main regulatory enzyme of cholesterol synthesis
   d) is activated by high concentration of cholesterol

336. Which of statements about regulation of cholesterol synthesis are correct:
   a) cholesterol inhibits reaction of mevalonic acid synthesis
   b) cholesterol activates HMG-CoA reductase
   c) regulatory enzyme is active in dephosphorylated form
   d) hormone glucagon causes inhibition of cholesterol synthesis by phosphorylation of HMG-CoA reductase

337. Chylomicrons:
   a) are lipoproteins formed in the liver
   b) from enterocytes are secreted into lymph
   c) in blood are degraded by lipoprotein lipase
   d) contain apoprotein C

338. Apoprotein A:
   a) is important component of HDL
   b) acts like activator of lipoprotein lipase
   c) is formed by liver cells
   d) is activator of LCAT

339. Apoprotein B:
   a) is main protein component of all lipoproteins
   b) is activator of liporotein lipase
   c) is main protein component of HDL
   d) is important for binding of LDL to specific receptors

340. Chylomicrons are lipoproteins which:
   a) are formed in intestine
   b) are responsible for transport of TAG from liver to cells of EHT
   c) are degraded by lipoprotein lipase
   d) require apoprotein C for their degradation

341. VLDL are lipoproteins which:
   a) are formed in liver
   b) transport mainly cholesterol
   c) contains around 90% of lipids

d) in blood are degraded by lipoprotein lipase

342. VLDL:
a) are lipoprotein transporting exogenous triacylglycerols
b) are lipoproteins with the lowest density
c) contain around 40% of proteins
d) in blood are changed to LDL by lipoprotein lipase

343. Apoprotein C:
a) is main component of LDL
b) is component of HDL where is required for action of LCAT
c) is activator of lipoprotein lipase
d) is required for catabolism of VLDL

344. Lipoprotein lipase is the enzyme which:
a) is responsible for degradation of TAG from food
b) is typical for hepatocytes
c) is responsible for degradation of cholesterol in chylomicrons
d) catalyzes hydrolysis of TAG in adipose tissue during starvation

345. Lipoprotein lipase:
a) is enzyme bound to external surface of endothelial cells in capillaries
b) is responsible for conversion of LDL to VLDL
c) is responsible for degradation of chylomicrons
d) in adipose tissue is activated by insulin

346. Lipoprotein lipase is enzyme which:
a) is in high activities in intestine
b) hydrolyzes tAG into glycerol and fatty acids
c) is activated by apoprotein B
d) is responsible for conversion of VLDL to LDL

347. LDL are lipoproteins which:
a) are formed in intestine
b) are formed in blood during degradation of vLDL by lipoprotein lipase
c) are formed in liver by degradation of chylomicrons
d) in high concentrations represent risk factor for evelopment of atherosclerosis

348. LDL:
a) are formed in blood from HDL
b) are responsible for transport of cholesterol from cells to the liver
c) contain apoprotein B as main protein component
d) are degraded in blood by lipoprotein lipase

349. HDL are lipoproteins which:
a) are formed ih hepatocytes
b) contain the highest amount of proteins
c) are responsible for transport of cholesterol into blood vessel wall
d) are source of apoprotein C for VLDL and chylomicrons

350. HDL are lipoproteins which:
a) are formed in adipocytes
b) contain the highest amount of phospholipids
c) contains enzyme LCAT
d) transport cholesterol from cells to the liver

351. Which of statements about HDL are correct:
    a) they are formed by cells of adipose tissue
    b) they are formed by liver in their nascent form
    c) they decrease risk of atherosclerosis
    d) they are metabolized by lipoprotein lipase

352. Lecithine-cholesterol acyltransferase (LCAT) is the enzyme which:
    a) is important for metabolism of chylomicrons
    b) is important for reverse cholesterol transport by HDL
    c) is activated by apoprotein A
    d) hydrolyzes cholesterol esters

353. Lecithine-cholesterol acyltransferase (LCAT):
    a) is formed by liver
    b) is required for transport of LDL into the cells of EHT
    c) catalyzes synthesis of cholesterolô esters
    d) uses as substrate lecithins which are components of plasma membranes

354. Which of following mechanisms participate in regulation of cholesterol content in cells:
    a) inhibition of LCAT by cholesterol
    b) inhibition of HMG-CoA reductase by high cholesterol concentration
    c) inhibitionn of LDL receptor synthesis by lyck of cholesterol
    d) activation of synthesis of receptors for lDL in low cholesterol concentration

355. When intracellular concentration of cholesterol increases:
    a) activity of HMG-CoA reductase increases
    b) synthesis of receptors for LDL is inhibited
    c) transport of HDL to the cells increases
    d) oxidation of cholesterol is activated

356. Cells gain energy required for their functions:
    a) by anaerobic oxidation of carbohydrates, lipids and proteins
    b) by all oxidation reduction reactions
    c) by oxidation of ATP and ADP
    d) by the processes called intermediary metabolism

357. Living organism:
    a) uses as direct source of energy energy rich compounds mainly ATP
    b) gains energy in oxidation-reduction processes
    c) produces ATP only in aerobic conditions
    d) can produce ATP in glycolysis also in anaerobic conditions

358. Human organism:
    a) takes as source of energy diretly energy rich compounds like ATP
    b) uses directly energy of glucose for all processes which require energy
    c) energy of foodstuffs converts to energy in ATP by reduction of substrates
    d) energy of foodstuffs converts to energy in ATP by oxidation of substrates

359. In cells of human organism:
    a) ATP is formed only in presence of oxygen
    b) ATP is formed mainly in lack of oxygen
    c) ATP is formed by processes which are located in mitochondria and cytosol
    d) ATP can be formed by process of substrate level phosphorylation

360. Cells can gain energy:
    a) by oxidation of main sorces of energy for example ATP
    b) by oxidation of carbohydrates, lipids and proteins
    c) only in aerobic conditions
    d) in cytosol by the process called oxidative phosphorylation

361. Oxidation of compounds in the cells:
    a) leads to synthesis of the same products as oxidation in vitro
    b) proceeds mainly by dehydrogenation
    c) releases enrgy mainly in the form of heat
    d) released energy uses for synthesis of energy rich compounds

362. Oxidation of compounds in vivo:
    a) is catalyzed by hydrolases
    b) is made only by removal of hydrogens – dehydrogenation
    c) is for example reaction of synthesis of lactate from pyruvate
    d) requires oxygen for oxidation of fatty acids

363. Glucose is compound which:
    a) is universal source of energy
    b) allows synthesis of ATP in pentose phosphate pathway
    c) is oxidized to CO_2 and H_2O in all cells of human organism
    d) requires oxygen for complete oxidation

364. Glucose:
    a) allows synthesis of ATP by its reduction in glycolysis
    b) allows synthesis of ATP mainly in cytosol
    c) is source of energy for all cells of human body
    d) allows synthesis of ATP in mitochondria and in cytosol

365. For synthesis of ATP from glucose:
    a) its activation is required
    b) metabolic processes located in cytosol and in mitochondria are required
    c) oxygen is required in all cells of human body
    d) substrate level phosphorylation in cytosol is required

366. Oxidation of compounds in the cells can be performed by:
    a) addition of electrons
    b) reaction of compounds with $NADH_2$
    c) enzymes which use FAD, NAD and NADP as coenzymes
    d) by reaction of compound with oxygen

367. Oxidation of compounds in vivo can proceed:
    a) by removal of hydrogens in reactions catalyzed for example by succinate dehydrogenase
    b) by removal of electrons
    c) by reaction with oxygen for example in hydroxylation reactions
    d) by dehydrogenation for example in conversion of lactate to pyruvate

368. Reduction of compounds in the cells:
    a) can be made by hydrogenation
    b) can proceed by reaction of compounds with oxygen
    c) can be made by removal of electrons
    d) can be made by addition of proton for example in reaction $HCO_3^- + H^+$

369. Reduction of compounds is possible:

a) by uptake of electrons
b) by dehydrogenation
c) by hydrogenation for example in reaction of β-hydroxybutyrate synthesis from acetoacetate
d) by removal of electrons for example during terminal oxidation

370. Compound is oxidized:
a) when receives electrons
b) when loses electrons
c) by reaction with for example NADP
d) by reaction with oxygen

371. Compound is reduced:
a) when receives electrons
b) when loses electrons
c) by reaction with for example FAD
d) when receives hydrogen

372. Dehydrogenation is reaction:
a) which is the most frequent mode of oxidation-reduction reactions
b) is reaction of conversion of alcohol to aldehyde
c) is reaction by which water is removed
d) which is used in synthesis of cholesterol

373. During dehydrogenation:
a) compounds are oxidized
b) hydrogens can be transfered to coenzyme FAD
c) hydrogens are transfered to coenzyme pyridoxalphosphate
d) hydrogens are transfered to coenzyme NAD

374. Dehydrogenation is:
a) reaction by which comounds are oxidized
b) reaction by which compounds are reduced
c) mode of oxidation of compounds for example in Krebs cycle
d) for example conversion of pyruvate to lactate

375. During oxidation reduction reactions energy is released:
a) by transfer of electrons from compound with lower oxidation-reduction potential to compound with higher oxidation-reduction potential
b) for example by transfer of hydrogens from $FADH_2$ to CoQ in terminal oxidation
c) for example by transfer of electrons from $FMNH_2$ to FeS protein in terminal oxidation
d) for example in reaction of glucose synthesis by gluconeogenesis

376. Energy rich compounds are compound which:
a) are formed in both aerobic and anaerobic conditions
b) contain bonds by hydrolysis of which energy more than 30 $kJ.mol^{-1}$ is released
c) are formed in mitochondria and endoplasmic reticulum
d) are used for activation of substrates

377. Energy rich bonds:
a) can be formed also in anaerobic conditions
b) are synthesized only in mitochondria
c) are bonds by hydrolysis of which energy more than 3 kJ/mol is released
d) are totally four types

378. Compounds with energy rich bonds:

a) are formed mainly by the process of oxidative phosphorylation
b) all cen be used for synthesis of ATP by substrate level phosphorylation
c) all contains phosphate
d) may contain phosphoanhydride bond – for example ATP and ADP

379. Which of following bonds belong to energy rich:
a) phosphodiester in NAD
b) acylphosphate present in acyl-CoA
c) acylphosphate present in 1,3-bisphosphoglycerate
d) enolphosphate which is formed during glycolysis

380. Bonds which belong to energy rich are:
a) acylphosphate present in aminoacyladenylate
b) thioester present in acetyl-CoA
c) guanidinium phosphate present in GTP
d) guanidinium phosphate uses for regeneration of ATP in working muscles

381. Phosphoanhydride energy rich bond:
a) is present in ATP
b) is source of energy for Na^+/K^+ ATP-ase
c) is present in DNA
d) is present in CTP which is used for phospholipid synthesis

382. Which of statements about phosphoanhydride energy rich bond are correct:
a) is present in ATP which can be synthesized in mitochondria
b) is present in GTP which can be synthesized by substrate level phosphorylation in mitochondria
c) is synthesized in mitochondria using substrate AMP a H_3PO_4
d) is present in UTP which is used for synthesis of glycogen

383. Acylphosphate energy rich bond:
a) is present in 1,3-bisphosphoglycerate
b) is used for synthesis of ATP by substrate level phosphorylation
c) contains the highest amount of energy
d) is present in intermediate of fatty aciod activation – acyladenylate

384. Acylphosphate energy rich bond is bond which:
a) is present in 3-phosphoglycerate
b) can be formed by reaction of fatty acids with ATP
c) can be formed by enolase
d) is used for synthesis of ATP by oxidative phosphorylation

385. Enolphosphate energy rich bond:
a) is present in enolpyruvate
b) contains the highest amount of energy
c) is formed by reaction of pyruvate with ATP
d) can be used for synthesis of ATP in anaerobic conditions

386. Phosphoenolpyruvate:
a) contains acylphosphate energy rich bond
b) can be used for synthesis of ATP by substrate level phosphorylation in mitochondria
c) is formed by dehydrogenation reaction
d) is compound for synthesis of which in gluconeogenesis GTP is required

387. Compound with guanidiniumphosphate energy rich bond:

a) is creatine phosphate
b) is formed in mucles during work
c) is direct source of energy for muscle contraction
d) can be used for synthesis of ATP by substrate level phosphorylation

388. Guanidinium phosphate energy rich bond:
a) is present in GDP
b) is present in compound which is storage form of energy in muscles
c) is specific donor of energy for gluconeogenesis
d) is formed by creatine kinase

389. Thioester energy rich bond is present in:
a) common intermediate of metabolism of carbohydrates, lipids and amino acids
b) compound which is product of activation of fatty acids
c) acyladenylate
d) S-acetyllipoate which is formed during oxidative decarboxylation of pyruvate

390. Thioster bond is bond which:
a) belongs to energy rich bonds
b) is formed by binding of fatty acids residues to phosphate in CoA
c) is present in intermediate of glyceraldehyde-3-phosphate oxidation to 1,3-bisphosphoglycerate
d) can be used for synthesis of ATP by substrate level phosphorylation in Krebs cycle

391. Energy released by spliting of energy rich bonds can be used for:
a) activation of substrate for example in synthesis of glucose-6-phosphate
b) active transport
c) transport of Na^+ onto the cells
d) synthesis of ATP by oxidative phosphorylation

392. Energy of guanidiniumphosphate energy rich bond can be used for:
a) synthesis of ATP by substrate level phosphorylation
b) transport of compounds through membranes
c) regeneration of ATP in muscles during work
d) proteosynthesis

393. Creatine phosphate is compound which:
a) contains guanidiniumphosphate energy rich bond
b) is direct source of energy in heart
c) is formed by creatine kinase
d) can be used for ATP synthesis by creatine kinase

394. Acetyl-CoA contains:
a) thioester energy rich bond
b) adenine nucleotide
c) bond which is used for synthesis of ATP by oxidative phosphorylation
d) energy rich bond which is also present in product of fatty acid activation

395. Which of following bonds belon to energy rich:
a) guanidiniumphosphate bond present in GTP
b) phosphoanhydride bond present in ADP
c) acylphosphate bond present in 1,3-bisphosphoglycerate
d) thioester bond present in CoA

396. Oxidoreductases are enzymes which:

a) catalyze oxidation of substrate
b) catalyze reduction of substrates
c) participate for example in synthesis of fatty acids
d) are also component of respiratory chain

397. Which of following enzymes belongs to oxidoreductases:
a) all enzymes of Krebs cycle
b) all enzymes of terminal oxidation
c) all enzymes of glycolysis
d) enzymes which allow synthesis of ATP by substrate level phosphorylation

398. Catalase is the enzyme which:
a) is located in cytosol
b) is located in peroxisomes
c) catalyzes reduction of hydrogen peroxide
d) catalyzes oxidation of hydrogen peroxide

399. H_2O_2:
a) can be formed by the action of aerobic dehydrogenases
b) by catalase is reduced to O_2
c) by catalase is reduced to H_2O
d) by peroxidase is reduced to H_2O

400. NAD is coenzyme which:
a) contains riboflavine
b) contains adenine nuceotide
c) binds two protons and two electrons during its reduction
d) is carrier of hydrogens in terminal oxidation

401. Monooxygenases are enzymes which:
a) belong to oxidoreductases
b) catalyze binding of molecula of O_2 into the substrate
c) catalyze hydroxylation of substrates
d) require $NADPH_2$ and oxygen

402. FAD is coenzyme which:
a) is derived for riboflavine
b) contains adenine nucleotide
c) during reduction binds one hydrogen and one electron
d) transfers hydrogens to terminal oxidation directly to cytochrome a

403. FAD:
a) is coenzyme of oxidoreductases
b) is coenzyme of monooxygenases
c) allows synthesis of 3 ATP by oxidative phosphorylation
d) is coenzyme which during reduction binds two hydrogen atoms

404. Monooxygenases:
a) catalyze binding of one oxygen atom into the substrate
b) catalyze reduction of substrates
c) are components of respiratory chain
d) by hydroxylation of substrates they increase solubility of compounds in water

405. Oxidation-reduction reactions in the cells:
a) can be catalyzed by dehydrogenases with coenzymes for example NAD or FAD

b) can be catalyzed by peroxidase, which produces H_2O_2
c) can catalze binding of oxygen into substrate – for example monooxygenases and dioxygenases
d) all are important for synthesis of ATP

406. Which of components of terminal oxidation transfers hydrogens:
a) NAD^+
b) FMN
c) Green complex IV
d) coenzyme Q

407. Which of components of terminal oxidation transfers only electrons:
a) FMN
b) CoQ
c) cytochromes for example cyt b_5
d) FeS protein

408. $NADH+H^+$ is coenzyme which:
a) is the coenzyme of monooxygenases
b) transfers hydrogens to FMN in respiratory chain
c) enables synthesis of 3 ATP by oxidative phosphorylation
d) when is oxidized 6 protons are transported into mitochondrial matrix

409. Carriers of hydrogens and electrons in terminal oxidation:
a) transfer electrons from system with higher oxidation-reduction potential to system with lower oxidation-reduction potential
b) are arranged in order:FMN, FeS-protein, cytochrome c, cytochrome b, coenzyme Q, cytochrome a and cytochrome a_3
c) transfer protons into mitochondrial matrix
d) catalyze synthesis of ATP by oxidative phosphorylation

410. Which of statements about carriers of electrons and hydrogens in terminal oxidation are correct:
a) coenzyme Q can take electrons from $FADH_2$ throug Green complex II
b) coenzyme Q during its reduction takes electron from FeS protein
c) coenzyme Q during its reduction takes two H^+ from mitochondrial matrix
d) cytochrome c oxidase is responsible for transfer of electrons from FeS protein to cytochrome c

411. When hydrogens are transfered to terminal oxidation by $NADH_2$:
a) FMN is the first acceptor
b) 6 H^+ are transported into intermembrane space
c) 3 ATP can be formed
d) coenzyme Q is the first acceptor

412. Green complex I:
a) is present in outer mitochondrial membrane
b) is NADH–ubiquinone reductase
c) transfers two hydrogens from $NADH_2$ to FeS–protein
d) is important for reoxidation of $FADH_2$ in terminal oxidation

413. FeS protein in terminal oxidation:
a) takes electrons from $FMNH_2$
b) transfers electrons directly to oxygen
c) transfers electron and proton to coenzyme Q
d) during reduction changes from Fe^{2+} into Fe^{3+}

414. Terminal oxidation is the process which:
   a) is located in inner mitochondrial membrane
   b) is used for reoxidation of coenzymes NAD and $NADP_2$
   c) produces gradient of protons which is used for synthesis of ATP
   d) is inhibited by compounds called uncouplers

415. Coenzyme Q is compound which:
   a) is part of Green complex II
   b) during reduction takes two hydrogens from FMN
   c) is oxidized by transfer of electrons to cytochrome c and cytochrome b
   d) is the first acceptor of hydrogens when donor of them is $FADH_2$

416. ATP/ADP translocase:
   a) is component of respiratory chain
   b) is important because of impermeability of inner mitochondrial membrane for ATP and ADP
   c) is antiport transport system
   d) transports ATP out of mitochondria to cytosol

417. ATP/ADP translocase is system which:
   a) is present in inner mitochondrial membrane
   b) is responsible for synthesis of ATP by oxidative phosphorylation
   c) is responsible for active transport of ATP and ADP
   d) can be inhibited by compounds called uncouplers

418. Cytochrome b in terminal oxidation:
   a) transfers electrons to coenzyme Q durings its reduction
   b) takes electrons from coenzyme Q during its oxidation
   c) contains ions of iron and copper
   d) transfers electrons form FeS protein to coenzyme Q

419. Ubiquinone-cytochrome c reductase is system which:
   a) is component of Green complex III
   b) is required in the process of oxidation of $NADH_2$ in terminal oxidation
   c) is required in the process of oxidation of $FADH_2$ in terminal oxdation
   d) is responsble for transfer of electrons to oxygen

420. Cytochrome c oxidase:
   a) is located in mitochondrial matrix
   b) contains ions of iron and copper
   c) transfers electrons to oxygen
   d) can be activated by CN^- ions

421. When $FADH_2$ is donor of hydrogens to respiratory chain, then:
   a) FMN is the first acceptor of hydrogens
   b) CoQ is the first acceptor of hydrogens
   c) 6 protons are transported to outer side of mitochondrial membrane
   d) 2 ATP can be formed

422. Mitochondrial ATP-ase:
   a) is present in mitochondrial matrix
   b) is enzyme of terminal oxidation
   c) contains F_0 subunitwhich represents proton channel
   d) contains F_1 subunit which synthesizes ATP form ADP and phosphate

423. Mitochondrial ATP-ase is enzyme which:
   a) consists of F_1 and F_0 subunits
   b) is responsible for hydrolysis of ATP
   c) uses energy of proton gradient for synthesis of aTP
   d) is responsible for transport of ATP into cytosol

424. Uncouplers for example dinitrophenol:
   a) inhibit process of terminal oxidation
   b) increase synthesis of ATP
   c) increase permeability of inner mitochondrial membrane for protons
   d) increase production of proton gradient

425. Process of terminal oxidation:
   a) is called also oxidative phosphorylation
   b) is inhibited by lack of oxygen
   c) is activated during hypoxia by lack of oxygen
   d) is activated by increased ratio ADP/ATP in mitochondria

426. Acetyl-CoA is compound which:
   a) is product of aerobic glycolysis
   b) is common intermediate of metabolism of carbohydrates, lipids and amino acids
   c) can be formed from ketogenic amino acids
   d) can be used for synthesis of cholesterol in mitochondria

427. Acetyl-CoA:
   a) can be formed in mitochondria by β-oxidation of fatty acids
   b) can be formed in mitochondria by pyruvate dehydrogenase
   c) can be formed in cytosol by utilization of ketone bodies
   d) can be formed in anaerobic conditions

428. Acetyl-CoA can be utilized in the cells:
   a) for oxidation in Krebs cycle in mitochondria
   b) for synthesis of fatty acids in cytosol
   c) for synthesis of ketone bodies in cytosol
   d) for synthesis of cholesterol in mitochondria

429. Utilization of acetyl-CoA is possible:
   a) in cytosol for synthesis of ATP
   b) for synthesis of mevalonate in cytosol
   c) for synthesis of ketone bodies in mitochondria
   d) for synthesis of glucose by gluconeogenesis

430. Acetyl-CoA can be formed:
   a) in aerobic conditions from pyruvate
   b) from pyruvate in reaction which requires TPP, lipoic acid, CoA, NAD and FMN
   c) from glucose by irreversible reaction
   d) during β-oxidation by spliting of β-ketoacyl-CoA

431. Acetyl-CoA:
   a) contains thioester energy rich bond
   b) can be formed in mitochondria and cytosol
   c) for synthesis of gfatty acids is used in cytosol where is transported in the form of citrate
   d) from fatty acids can be formed also in anaerobic conditions

432. Utilization of acetyl-CoA for ketone bodies synthesis:

a) proceeds in cytosol
b) requires enzymes acetoacetyl-CoA thiolase, HMG-CoA synthase and HMG-CoA lyase
c) leds to synthesis of mevalonate as intermediate
d) is activated by insulin

433. Which of statements about utilization of acetyl-CoA are correct:
a) oxidation of acetyl-CoA in Krebs cycle allows synthesis of 12 ATP
b) utilization of acetyl-CoA for cholesterol synthesis requires $NADPH_2$
c) utilization of acetyl-CoA for fatty acid synthesis is activated during starvation
d) utilization of acetyl-CoA for ketone bodies synthesis proceeds only in liver

434. Acetoacetyl-CoA:
a) can be formed as intermediate of β-oxidation of fatty acids
b) in intermediate of conversion of acetyl-CoA to ketone bodies
c) can be formed during utilization of ketone bodies by succinyl-CoA transferase
d) can be hydrolyzed into two acetyl-CoA

435. Acetoacetyl-CoA is compound which:
a) is formed form two acetyl-CoA in tthe process of ketone bodies synthesis
b) in synthesis of ketone bodies is formed by β-ketothiolase
c) in utilization of ketone bodies is formed by β-ketothiolase
d) in utilization of ketone bodies is changed by β-ketothiolase

436. Ketone bodies are compounds which:
a) are formed only in pathological conditions
b) are synthesized from immediate precursor acetoacetyl-CoA
c) what cannot be utilized in red blood cells
d) what are utilized in all cells of human body

437. Which of following compounds belong to ketone bodies:
a) all compounds with keto group
b) β-hydroxybutyrate
c) β-hydroxy-β-methylglutaryl-CoA
d) compound formed from β-hydroxy-β-methylglutaryl-CoA by HMG-CoA lyase

438. Acetone is compound which:
a) belongs to ketone bodies
b) is formed from acetoacetate by spontaneous decarboxylation
c) can be utilized in extrahepateic tissues for synthesis of ATP
d) causes acidosis when is in high concentration

439. β-hydroxy-β-methyl-glutaryl-CoA:
a) is formed from acetoacetate and acetyl-CoA
b) is intermediate in ketone bodies synthesis
c) in extrahepatic tissues can be changed to acetoacetate
d) is product of β-oxidation

440. Under physiological conditions:
a) ketone bodies are utilized in brain
b) ketone bodies are not formed
c) ketone bodies are not excreted by urine
d) myocardial cells can oxidize ketone bodies for ATP synthesis

441. Acetoacetyl-CoA is broken by β-ketothiolase:

a) during ketone bodies synthesis
b) during ketone bodies utilization in extrahepatic tissues
c) into 2 molecules of acetone
d) into 2 molecules of acetyl-CoA

442. Which of following compounds is required for utilization of ketone bodies:
a) β-hydroxy- β-methyl glutaryl-CoA
b) acetyl-CoA
c) succinyl-CoA
d) intermediate of Krebs cycle with thioester energy rich bond

443. Synthesis of ketone bodies:
a) proceeds in cytosol of liver cell
b) proceeds also under phasiological conditions and ketone bodies serve as source of energy for extrahepatic tissues
c) is increased in diabetes
d) in starvation is inhibited by glucagon

444. Ketegenesis is the process which:
a) requires HMG-CoA lyase
b) leads to synthesis of acetoacetate, β-hydroxybutyrate and acetone
c) uses acetyl-CoA as basic substrate
d) during starvation and diabetes is activated by insulin

445. Ketone bodies are compounds which:
a) are formed in skeletal muscle
b) are formed only in pathologic conditions
c) cannot be metabolized in liver
d) can be oxidized in brain

446. Acetoacetate is compound which:
a) is formed by HMG-CoA lyase during ketone bodies synthesis
b) is formed by β-hydroxybutyrate dehydrogenase durin extrahepatal utilization of ketone bodies
c) in high concetrations can cause acidosis
d) can be utilized in liver

447. Acetoacetate is compound about which can be said:
a) belongs to ketone bodies
b) it is compound which can be used for synthesis of ATP in all cells of human body
c) for its synthesis 3 acetyl-CoA are used
d) in extrahepatic tissues is activated by reaction with ATP

448. Process of ketone bodies synthesis:
a) requires acetyl-CoA as basic substrate
b) requires enzyme thiolase
c) requires enzyme HMG-CoA reductase
d) is activated by high glucose concentration

449. During process of ketone bodies synthesis:
a) acetoacetyl-CoA is formed from HMG-CoA
b) HMG-CoA is synthesized form acetoacetyl-CoA and acetyl-CoA
c) HMG-CoA is synthesized by HMG-CoA lyase
d) acetone is formed by spontaneous decarboxylation of acetoacetate

450. HMG-CoA is compound which:
   a) is formed by reaction of acetoacetate with acetyl-CoA
   b) requires energy form ATP for conversion into acetoacetate
   c) is changed to acetone by HMG-CoA lyase
   d) as intermediate of ketone bodies synthesis i synthesized in mitochondria

451. Hydroxybutyrate dehydrogenase:
   a) is enzyme required in the process of ketone bodies synthesis
   b) is enzyme required for extrahepatal utilization of ketone bodies
   c) uses FAD as coenzyme
   d) is in high activities in myocardium

452. β-hydroxybutyrate:
   a) can be used for synthesis of ATP in brain during starvation
   b) in the liver is formed by β-hydroxybutyrate dehydrogenase
   c) can be decarboxylated to acetone
   d) requires NAD and hydroxybutyrate dehydrogenase for its utilization in extrahepetic tissues

453. β-hydroxybutyrate is compound which:
   a) is synthesized in cytosol of liver cells
   b) contains keto goup and thus belongs to ketone bodies
   c) is formed by reduction of acetoacetate
   d) is formed in higher concentrations in patients with diabetes melllitus

454. Which cells of human body cannot utilize ketone bodies:
   a) red blood cells
   b) skeletal muscle
   c) liver
   d) brain cells

455. Extrahepatal utilization of ketone bodies:
   a) is important source of energy in heart
   b) requires conversion of acetoacetate into acetoacety-CoA by CoA-transferase
   c) proceeds in anaerobic conditions
   d) is increased in diabetes

456. Reaction of conversion of acetoacetate into acetoacetyl-CoA:
   a) requires enzyme succinyl-CoA transferase
   b) requires ATP
   c) requires HMG-CoA
   d) is catalyzed by enzyme which is absent in liver

457. Malonyl-CoA is compound which:
   a) is formed as intermediate of fatty acid synthesis
   b) regulates transport of fatty acids into mitochodria and their oxidation
   c) activates carnitineacyltransferase I
   d) by accitavtion of fatty acid oxidation increases synthesis of ketone bodies

458. Malonyl-CoA:
   a) regulates process of ketogenesis by inhibition of transport of fatty acids into mitochondria and their oxidation
   b) is formed in cytosol by acetyl-CoA carboxylase
   c) is formed by enzyme which is active in phosphorylated form
   d) is intermediate of fatty acid synthesis does not participate in regulation of their oxidation

459. Increased synthesis of ketone bodies in diabetes is caused by:
   a) increased concentration of glucose in blood
   b) increased oxidation of fatty acids
   c) increased activity of hormone senstive lipase due to absence of antilipolytic effect of insulin
   d) decreased utilization of acetyl-CoA in Krebs cycle

460. Factors which stimulate synthesis of ketone bodies in diabetes and starvation are:
   a) decreased lipolysis in adipose tissue
   b) decreased utilization of acetyl-CoA in fatty synthesis
   c) activation of enzymes of β-oxidation by glucagon
   d) increades degradation of triacylglycerols in adipose tissue

461. In regulation of ketone bodies synthesis participate:
   a) inhibition of hormone sensitive lipase by insulin
   b) increased oxidation of acetyl-CoA in Krebs cycle
   c) activity of acetyl-CoA carboxylase which allows utilization of acetyl-CoA in fatty acid synthesis
   d) regulation of β-oxidation by insulin

462. In activation of ketone bodies synthesis participate:
   a) lipolysis in adipose tissue stimulated by change of hormone sensitive lipase into active – phosphorylated form
   b) increased transport of acetyl-CoA into the liver
   c) decreased utilization of acetyl-CoA in fatty acid synthesis
   d) increased oxidation of fatty acids caused by increased activity of carnitine acyltransferase

463. Increased concentration of ketone bodies causes:
   a) ketonemia
   b) ketonuria
   c) decrease of pH – acidosis
   d) diabetes mellitus

464. Increased concentration of ketone bodies in blood in diabetes:
   a) is caused by increased synthesis of ketone bodies in liver
   b) is caused by increased utilization of ketone bodies in brain
   c) is related to increased oxidation of fatty acids
   d) can cause metabolic acidosis which is compensated by hyperventilation

465. Increased concetration of ketone bodies in blood:
   a) is typical for diabetes mellitus I. type
   b) is found during starvation
   c) is caused by activation of ketogenesis in liver
   d) by increased proton concentration increases pH

466. Among glucogenic amino acids belong:
   a) cysteine, serine, alanine
   b) amino acid which is formed by transamination of pyruvate
   c) alanine, leucine
   d) glutamate, aspartate

467. Glutamate:
   a) is glucogenic amino acid
   b) by oxidative deamination is converted to 2-oxoglutarate by help of glutamate dehydroganase
   c) is important donor of amino group for synthesis of essential amino acids
   d) is part of tripeptide which is needed in oxidation-reduction reactions

468. Oxidases of amino acids:
    a) have coenzyme pyridoxal-5-phosphate
    b) belong to aerobic dehydrogenases
    c) have coenzymes FAD or FMN
    d) are located mainly in peroxisomes of hepatocytes

469. Which of following amino acids enter Krebs cycle through succinyl-CoA:
    a) glutamate
    b) methionine
    c) valine
    d) leucine

470. Which of following amino acids enter Krebs cycle through ketoglutarate:
    a) all glucogenic amino acids
    b) all ketogenic amino acids
    c) histidine
    d) arginine

471. Glutamate dehydrogenase:
    a) is located in cytosol of cell
    b) catalyzes reversible reaction located in mitochondria
    c) reduced form of its coenzyme gives in respiratory chain 3 ATP
    d) plays role in synthesis of non essential amino acids where is needed reductive amination of 2-oxoglutarate

472. Glutamate dehydrogenaseis enzyme which:
    a) catalyzes oxidative deamination of glutamate
    b) can be used for synthesis of glutamate
    c) uses FMN as coenzyme
    d) allows synthesis of 3 ATP by oxidative phosphorylation

473. Glutamate dehydrogenase:
    a) is enzyme present in mitochondria
    b) catalyzes synthesis of ketoglutarate from glutamate
    c) can use ketoglutarate as substrate
    d) participates in indirect deamination of amino acids

474. Decarboxylation of glutamate:
    a) requires FMN as the coenzyme
    b) leads to synthesis of gamma aminobutyrate
    c) is important for synthesis of phospholipids
    d) leads to synthesis of inhibitory neurotransmitter

475. Indirect deamination of amino acids requires:
    a) coenzyme pyridoxal-5-phosphate (in the first phase)
    b) coenzyme NAD (in the second phase)
    c) specific amino transferase
    d) acetoacetate

476. Ammonia is transported from tissues to the liver in a form of:
    a) urea
    b) uric acid
    c) glutamine

d) compound which is formed by glutamine synthetase which requires ATP

477. Serine is deaminated:
   a) by serine dehydratase coenzyme of which is FMN
   b) by deamination which belong to direct deaminations
   c) by serine dehydratase coenzyme of which is active form of vitamine B_6
   d) and product of reaction is oxaloacetate

478. Cysteine:
   a) if is deaminated product is compound important for gluconeogenesis
   b) is substrate for formation of glutathion
   c) is deaminated by cysteine desulfhydrase and coenzyme is NAD
   d) product of deamination is 2-oxoglutarate

479. By decarboxylation:
   a) of amino acid is formed primary amine
   b) are formed amines important in regulatory reactions
   c) of serine is formed histamine
   d) of amino acid with hydroxy group in molecule is formed amine important for synthesis of phospholipids

480. Coenzyme of decarboxylases of amino acids is:
   a) active form of vitamine B_5
   b) active form of vitamine B_6
   c) coenzyme which is coenzyme of cysteine desulfhydrase
   d) coenzyme which is common for AST, ALT and also for decarboxylases of amino acids

481. Essential amino acids:
   a) must be taken by food
   b) are those which can be synthetised by organism
   c) are e.g. valine, leucine and isoleucine
   d) can be substrate for synthesis of conditionally essential amino acids

482. Aspartate aminotransferase:
   a) utilizes aspartate + 2-oxoglutarate as the substrates
   b) utilizes oxaloacetate + glutamate as the substrates
   c) is located in mitochondria
   d) requires NAD as coenzyme

483. Ammonia:
   a) is released from amino acids by amino acid oxidases
   b) causes increase of pH
   c) in the kidney is detoxified into urea
   d) in the blood is transported as glutamate

484. Alanine aminotransferase:
   a) utilizes alanine as substrate
   b) is part of glucose-alanine cycle
   c) has pyridoxal phosphate as the coenzyme
   d) is the enzyme typical for the liver tissue

485. Glutamine:
   a) is formed by decarboxylation of glutamate
   b) is intermediate of urea cycle
   c) is transport form of ammonia from tissues to the liver

d) its synthesis from glutamate requires ATP

486. Decarboxylation of glutamate:
a) requires NAD as the coenzyme
b) leads to the synthesis of gamma aminobutyrate
c) catalyzes synthesis of primary amine
d) needs ATP as a source of energy

487. Glutamate dehydrogenase:
a) is enzyme present in mitochondria
b) catalyzes synthesis of 2-oxoglutarate
c) catalyzes irreversible reaction
d) participates in indirect deamination of amino acids

488. Ammonia:
a) can be formed by serine dehydratase
b) its synthesis by amino acid oxidases needs NAD
c) is detoxified into uric acid in humans
d) is transported in the blood as glutamate

489. Decarboxylation of serine:
a) synthesizes pyruvate
b) produces compound requires for synthesis of choline
c) requires pyridoxalphosphate as coenzyme
d) is important for phospholipids synthesis

490. Ammonia:
a) is formed by glutamate dehydrogenase
b) is toxic compound for living cells
c) in kidney is released by glutaminase
d) in cells binds to glutamate

491. Pyruvate:
a) is compound formed from aspartate by its decarboxylation
b) is product of ALT
c) is substrate of ALT
d) is formed from serine in the presence of FMN

492. Alanine aminotransferase:
a) is enzyme typical for the liver tissue
b) utilizes pyruvate as the substrate
c) is part of malate shuttle
d) uses thiamine as coenzymes

493. Carbamoylphosphate:
a) brings to urea 2 -NH_2 groups
b) is released from arginine
c) during its synthesis ATP is formed
d) is compound through which free ammonia enters urea cycle

494. During urea cycle:
a) ammonia is detoxified to uric acid in humans
b) aspartate enters by its reaction with ornithine
c) fumarate is released from argininesuccinate
d) 3 ATP are formed

495. Urea $(NH_2)_2CO$:
   a) in human is final product of purine nucleotides degradation
   b) is well soluble in water and easily cross membranes
   c) is compound which is synthetised in the liver
   d) in ureotelic organisms is final product of detoxification of ammonia

496. Enzymes of urea cycle:
   a) are inductive and their amount is increased during increased catabolism of proteins
   b) are costitutive and their amount is increased mainly during starvation
   c) their production is stimulated by glucocorticoids
   d) are comletely present only in the liver

497. Universal acceptor of of amino group from majority of all amino acids can be:
   a) oxaloacetate
   b) 2- oxoglutarate
   c) 5- carbon oxoacid which is intermediate of Krebs cycle
   d) oxoacic which is formed in metabolism of ketone bodies

498. Pyruvate:
   a) is formed from alanine by the action of AST
   b) is formed by deamination of serine
   c) in the liver is used for gluconeogenesis
   d) for its synthesis from cysteine NAD is required

499. During urea cycle:
   a) aspartate enters by its reaction with citrulline
   b) urea is formed by hydrolysis of arginine
   c) 3 ATP are formed
   d) argininosuccinate is brokeninto arginine

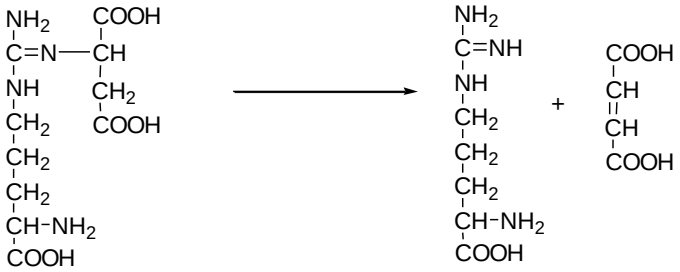
500. Glutamine:
   a) for its synthesis ATP is required
   b) is transport form of ammonia from tissues to the liver
   c) is product of glutamate decarboxylation
   d) in kidney tubular cells is hydrolyzed releasing ammonia

501. Aminoacid which is donor of one amino group in urea:
   a) after transamination with 2-oxoglutarate can enter Krebs cycle
   b) belongs to the neutral amino acids
   c) is amino acid which creates bigger part of carbon sceleton of pyrimidine ring
   d) is formed by transamination of pyruvate

502. Ornithine transcarbamoylase:
   a) is enzyme of urea cycle
   b) is enzyme locatedin cytosol of hepatocyte
   c) is enzyme located in mitochondria of periportal hepatocyte
   d) catalyzes production of arginine from ornithine and carbamoyl phosphate

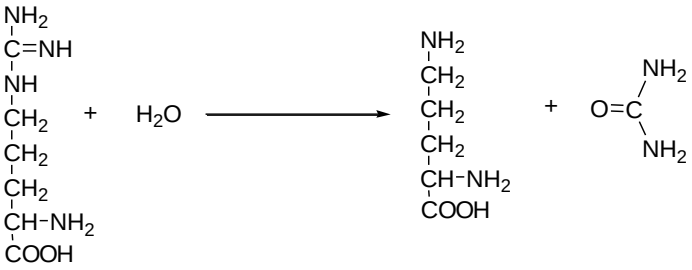
503. Arginase:
   a) is located in cytosol of hepatocyte
   b) is hydrolase and cleveas arginine to ornithine and urea in cytosol of hepatocyte
   c) is hydrolase and belongs to the enzymes of Krebs cycle
   d) is enzyme required for synthesis of arginine

504. Reaction



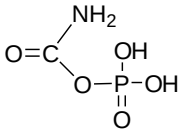
a) is catalyzed by hydrolytic enzyme
b) is located in cytosol of liver cells
c) uses as substrate compound for synthesis of which aspartate is required
d) is reaction of urea cycle

505. Reaction

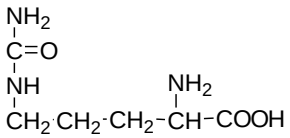


a) proceeds in cytosol of periportal hepatocytes
b) is catalyzed by arginase
c) is reaction imúportant for detoxification of ammonia by uric acid synthesis
d) is reversible reaction

506. Compound:

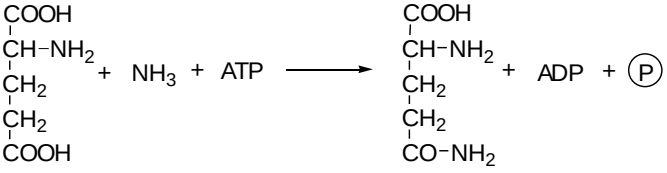


a) is substrate for synthesis of compound:



b) is compound through which free ammonia enters urea cycle
c) is synthesized by carbamoylphosphate synthase I in mitochondria of liver cells
d) can be synthesized in cytosol by carbamoylphosphate synthase II

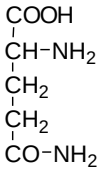
507. Which of following statements about this reaction are correct:



a) reaction is catalyzed by glutaminase
b) it is reaction of indirect deamination of amino acids
c) product of reaction represents non-toxic transport form of ammonia

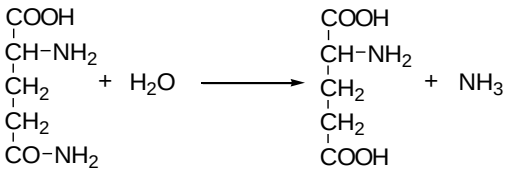
d) product of reaction is important also for regulation of acid-base balance in kidneys

508. Compound:



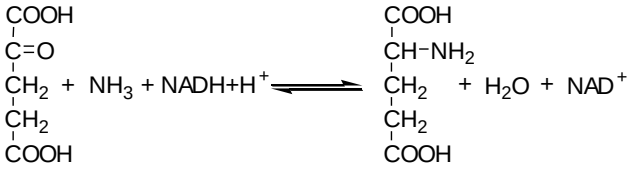
a) is amide of aspartic acid
b) is the most important transport form of ammonia
c) is formed by glutamine synthase
d) is liver is important for regulation of acid-base balance

509. Reaction:



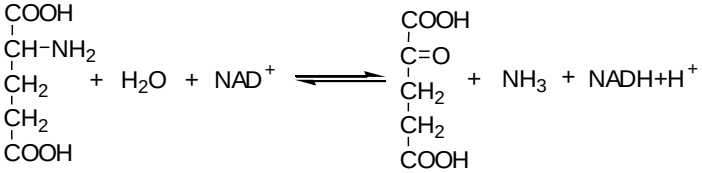
a) is catalyzed by glutaminase
b) requires ATP as source of energy
c) is kidneys is important for regulation of pH of urine
d) produces free ammonia which is used for urea synthesis in liver

510. Reaction:



a) is catalyzed by glutamate dehydrogenase
b) is catalyzed by amino acid oxidases
c) is important for synthesis of non-essential amino acids
d) in high concentration of ammonia decreases amount of ketoglutarate in Krebs cycle which leads to decreased ATP synthesis

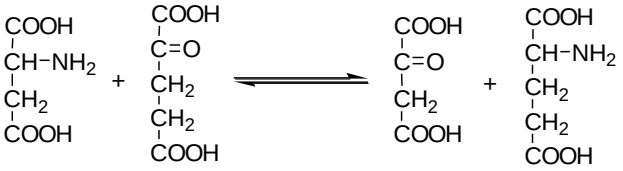
511. Which of statements about this reaction are correct:



a) reaction is catalyzed by glutamate dehydrogenase
b) reaction is one step of indirect deamination of amino acids
c) substrate of reaction is formed by transaminase
d) reaction is located in cytosol

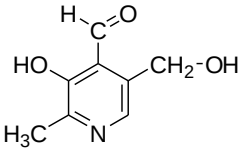
512. Aspartate aminotransferase:
a) catalyzes reversible reaction

b) catalyzes reaction:

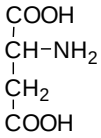


c) is important for utilization of aspartate in gluconeogenesis

d) uses as coenzyme



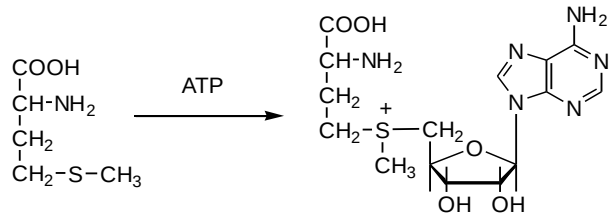
513. Compound:



a) is substrate of aspartate aminotransferase
b) is product of aspartate aminotransferase
c) can be synthesized from oxaloacetate
d) is compound for synthesis of which pyridoxalphosphate is required

514. S-adenosylmethionine:

a) is formed by reaction

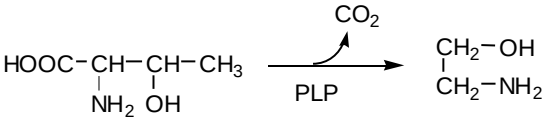


b) is used for creatine synthesis
c) is source of methyl group in synthesis of adrenaline
d) is source of methyl group in synthesis of thymine

515. Decarboxylation of serine:

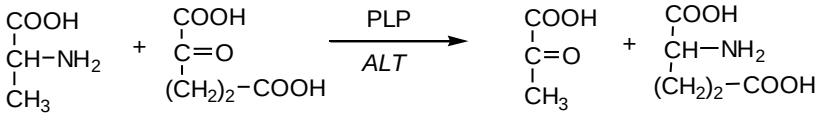
a) leads to synthesis of β-alanine
b) requires pyridoxalphosphate as coenzyme
c) is important for phospholipid synthesis

d) proceeds by reaction:



516. Transamination of alanine:

a) requires amino acid oxidase
b) requires pyridoxalphosphate as coenzyme
c) is important for utilization of alanine in gluconeogenesis
d) proceeds by reaction



Answers:

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