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MEDICAL  
UNIVERSITY**



**Medical faculty**

**BIOLOGY and CHEMISTRY**  
**The set of Entrance Exam Questions for**  
**Medical Faculty and Faculty of Public Health**



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**Contens:**

**Biology .....4**

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# **BIOLOGY**

Biology - correct answers are selected

1. What scientific study does consider the structure of living things?
  - a. anthropology
  - b. physiology
  - c. anatomy
  - d. organology
  
2. Anatomy is the biological discipline dealing with:
  - a. structure of organs, organ systems and whole living organism
  - b. study of spiders
  - c. biology of humans
  - d. external structure of plant body
  
3. What scientific study is concerned with microscopic anatomy of animal and plant tissues?
  - a. anatomy
  - b. cytology
  - c. histology
  - d. physiology
  
4. Histology is the biological discipline dealing with:
  - a. structure of animal and plant cells
  - b. study of animal tissues
  - c. study of plant tissues
  - d. life processes at cellular level
  
5. Life processes of organisms are studied by:
  - a. physiography
  - b. physiology
  - c. physiognomy
  - d. ethology
  
6. Physiological sciences deal with:
  - a. evolutionary changes of organisms
  - b. relationship that living organisms have with their natural environment
  - c. life processes in organisms
  - d. functions of individual organs
  
7. Paleontology deals with:
  - a. the ontogenesis of organisms
  - b. extinct organisms
  - c. fossils
  - d. dinosaurs
  
8. Anthropology deals with:
  - a. study of humans
  - b. study of spiders
  - c. study of extinct plants
  - d. an individual development of organisms

9. Ethology is the biological discipline dealing with:
- life processes of animals
  - development of animals
  - behaviour of animals
  - animal impact on environment
10. What scientific study does consider animal behaviour?
- ethnology
  - ecology
  - ethology
  - physiography
11. Who is the founder of biology as a scientific discipline?
- Ch. R. Darwin
  - Aristotle (Aristoteles)
  - K. Linné
  - K. Lorenz
12. What do Galenos, Avicena and W. Harvey (as representatives of historical biology) have in common?
- they were botanists
  - they contributed to organism classification
  - they were physicians
  - they dealt with pathogenic microorganisms
13. What do M. J. Schleiden, T. Schwann and J. E. Purkyňe (as representatives of historical biology) have in common?
- they were physicians
  - they were founders of microbiology
  - they independently observed cells for the first time in history
  - they independently formulated the cell theory
14. Who did perform the first public autopsy in Czech Republic?
- J. E. Purkyňe
  - J. G. Mendel
  - J. Jesenius
  - A. Vesalius
15. Who did contribute to the discovery of blood types?
- J. Janský
  - J. Jesenius
  - K. Landsteiner
  - M. Rhesus

16. Who from the following representatives did make the real progress in human physiology?

- a. I. P. Pavlov
- b. W. Harvey
- c. J. E. Purkyňe
- d. J. B. Lamarck

17. Who is the author of the theory of evolution?

- a. I. P. Pavlov
- b. Ch. R. Darwin
- c. A. I. Oparin
- d. J. G. Mendel

18. Who is the founder of classical genetics?

- a. L. Pasteur
- b. Ch. R. Darwin
- c. J. G. Mendel
- d. I. P. Pavlov

19. Who from the following representatives did contribute to the forming of the theory of evolution before Darwin?

- a. J. B. Lamarck
- b. J. G. Mendel
- c. K. Linné
- d. T. Malthus

20. In 1973, K. Lorenz, N. Tinbergen and K. Frisch received the Nobel Prize for:

- a. ecology
- b. embryology
- c. ethology
- d. physiology

21. In 1962, J. D. Watson, F. H. C. Crick and M. H. F. Wilkins received the Nobel Prize for:

- a. forming the laws of inheritance
- b. discovering the molecular structure of nucleic acid
- c. discovering the nucleic acids function in genetic information transfer
- d. discovering the various mutation types

22. Comparing to the observation, we can say about the experiment:

- a. we use instruments (apparatus)
- b. the events of nature are in our control
- c. it takes place under laboratory conditions
- d. it is the scientific method

23. If we want to avoid the random error, we must:
- write down the results
  - set a target
  - repeat the experiment several times
  - use the model organisms
24. The statement that all living organisms are open systems means that they exchange:
- substances, energy and information
  - just substances and energy
  - just information
  - just the energy
25. The term "metabolism" means:
- the uptake of substances from environment into a cell
  - all catabolic and anabolic processes within a cell
  - the transformation (conversion) of substances and energy within an organism
  - synthesis and catabolism of substances
26. What happens within the cell during anabolic processes?
- consumption of the energy
  - releasing of the energy
  - formation of complex substances from simple ones
  - cleavage of complex substances to simple ones
27. What happens within the cell during catabolic processes?
- consumption of the energy
  - releasing of the energy
  - formation of complex substances from simple ones
  - cleavage of complex substances to simple ones
28. What are we talking about if complex substances are cleaved into simple ones?
- anabolic processes
  - catabolic processes
  - assimilation processes
  - dissimilation processes
29. What are we talking about if complex substances are synthesized from simple ones?
- assimilation processes
  - dissimilation processes
  - anabolic processes
  - catabolic processes
30. What happens with energy within the cell during anabolic processes?
- it is consumed
  - it is released
  - it is lost
  - it is produced

31. What happens with energy within the cell during catabolic processes?

- a. it is lost
- b. it is transformed
- c. it is consumed
- d. it is released

32. What happens with energy during exergonic reactions?

- a. it is released
- b. it is consumed
- c. it is lost
- d. it is transformed

33. What happens with energy during endergonic reactions?

- a. it is lost
- b. it is produced
- c. it is released
- d. it is consumed

34. Respiration is:

- a. a catabolic process
- b. an exergonic reaction
- c. an anabolic process
- d. an endergonic reaction

35. Photosynthesis is:

- a. a catabolic process
- b. an exergonic reaction
- c. an anabolic process
- d. an endergonic reaction

36. Which of the following reactions is anabolic one?

- a. the synthesis of ATP
- b. the protein synthesis
- c. the respiration
- d. the fermentation

37. Which of the following reactions is catabolic one?

- a. the respiration
- b. the fermentation of lactic acid
- c. the replication of DNA
- d. the oxidation of saccharides (carbohydrates)

38. If the energy is consumed during the biochemical reaction within the cell, we can speak about:

- a. anabolic reaction
- b. catabolic reaction
- c. assimilation process
- d. dissimilation process

39. If the energy is released during the biochemical reaction within the cell, we can speak about:

- a. assimilation
- b. dissimilation
- c. anabolism
- d. catabolism

40. Under what conditions the biological oxidation can take place?

- a. only in the presence of oxygen
- b. under anaerobic and aerobic conditions
- c. also in the absence of oxygen
- d. only under aerobic conditions

41. Where does the anaerobic glycolysis take place?

- a. in the cytoplasm of all active cells
- b. in mitochondria
- c. only in the cytoplasm of prokaryotic cells
- d. in the endoplasmic reticulum

42. The biological oxidation means:

- a. the definite sequence of reactions that provide the cleaving off the carbon from the biological substrate
- b. the stepwise cleavage of organic substances resulting in the release of the energy
- c. all anabolic processes (within the cell) in the presence of oxygen
- d. processes of cytoplasm oxygenation

43. Aerobic respiration is:

- a. the oxygen exchange between blood and lung alveoli
- b. a complete oxidation of organic substances in the presence of oxygen
- c. the blood oxygenation
- d. the cleavage of glucose in the absence of oxygen

44. Respiratory quotient RQ means:

- a. the oxygen uptake that is used for the glucose oxidation
- b. the intensity of breathing (respiration)
- c. the ratio of produced  $\text{CO}_2$  and consumed  $\text{O}_2$
- d. the dependence of the released energy on consumed  $\text{O}_2$  during the breathing process

45. What form of energy is used by cells for their life processes?

- a. luminous energy
- b. energy of chemical bonds
- c. thermal energy
- d. they can use all of energy types

46. What chemical compound is known as the universal energy (transfer) molecule within the cell?

- a. ATP molecule
- b. adenosinotriphosphatic acid (adenosine triphosphate)
- c. active chlorophyll a
- d. adenine molecule

47. What is the ATP molecule within the cell used for?

- a. it is universal energy (transfer) molecule
- b. it is a stimulant of chemical reactions
- c. it is the source of nitrogenous bases
- d. it is the energy storage

48. Is the molecule of ATP able to transfer the energy from one cell to another?

- a. yes, it is universal energy transfer molecule
- b. yes, it is small molecule that can pass through the cytoplasmic membrane
- c. no, it passes easily only through mitochondrial membrane to the cytoplasm
- d. no, energetic metabolism takes place in each cell separately

49. Which of the following organisms do not have their own metabolism?

- a. algae
- b. bacteria
- c. viruses
- d. endoparasites

50. Homeostasis is:

- a. equilibrium state between organisms and their environment
- b. the ability of organisms to take in the essential substances from their environment
- c. constancy (stability) of the inner environment of organisms
- d. the ability to develop

51. Constancy (stability) of the inner environment of organism is called:

- a. homonymy
- b. homeostasis
- c. homology
- d. isonymy

52. Which of the following options does make the self-regulation (as an ability of an organism) possible?

- a. reactions to stimuli
- b. reflexes
- c. the feed-back system
- d. the immune response

53. Which of the following organisms are non-cellular?

- a. viruses, bacteria and cyanobacteria
- b. just viruses
- c. just bacteria and cyanobacteria
- d. non-cellular organisms do not exist

54. What is the cell colony?

- a. the cell organization of *Volvox globator*
- b. protozoan cells that stay together after division
- c. bacteriophages in their host (bacteria)
- d. plasmodia in the blood of their host

55. Organisms are divided into autotrophs and heterotrophs according to the way of:

- a. carbon intake
- b. oxygen intake
- c. nitrogen intake
- d. potassium intake

56. Heterotrophic organisms:

- a. feed on organic substances
- b. produce organic substances from inorganic ones
- c. take in the carbon as a carbon dioxide
- d. take in the carbon as an organic substance

57. Autotrophic organisms:

- a. feed on organic substances
- b. they take in the carbon as an organic substance
- c. they produce the organic substances from inorganic ones
- d. they take in the carbon as a carbon dioxide

58. With increasing temperature the oxygen content of water is:

- a. decreasing
- b. increasing
- c. remains constant
- d. it does not depend on temperature

59. For biotic factors of environment are regarded:

- a. factors which influence living organisms
- b. components of the internal environment of organisms
- c. food and water
- d. influence of other organisms

60. Individuals of the same species living together at the same time, in the same location, with the possibility of transfer of genetic information are called:

- a. species
- b. community
- c. ecosystem
- d. population

61. Population is characterised as:

- a. individuals of the same species, living in a specifically defined area at the same time
- b. individuals of several types of species in a specifically defined area
- c. all the plants and animals on Earth, living at the same time
- d. all the individuals of one species on Earth

62. Viruses can be observed:

- a. by light microscopy at 1000x enlargement
- b. only by electron microscopy
- c. by light microscopy using specific dye
- d. it is not possible to observe them by microscopy

63. The following statement is valid for prokaryotic organisms:

- a. its body is composed of one cell
- b. it is a virus
- c. the nucleus in the cell is without nuclear membrane
- d. they are always haploid organisms

64. Viruses belong to:

- a. prokaryotic organisms
- b. eukaryotic organisms
- c. nucleoprotein particles
- d. non-cellular organisms

65. Viruses consist of:

- a. DNA and RNA, surrounded by a protein shell
- b. DNA or RNA and protein
- c. DNA, RNA and lipid shell
- d. nucleic acid and virion from lipid particles

66. For proliferation of viruses is valid the following statement:

- a. depends on the host cell
- b. begins with producing spores
- c. it is conducted by binary fission of the virion
- d. it usually leads to the death of host cell

67. Characteristic for viruses from the life processes point of view is that:

- a. they have simple metabolism
- b. their life processes depend on the host cell
- c. their metabolism begins in the S- phase of the cell cycle
- d. they do not have their own metabolism, they are not able of self reproduction

68. Proliferation of bacteriophages is carried out:

- a. in infected animal cells
- b. in the interstitial space in host organism's tissues
- c. in bacterial cells, where the DNA of bacteriophage penetrates
- d. on the surface of host bacteria, where the DNA replicates

69. Is the following statement correct? Viruses can proliferate outside the host cell.
- a. no, they do not have their own genome, that is why they have to use the host cell's DNA for their reproduction
  - b. no, they do not have their own metabolism, that is why they are not able to perform any vital functions on their own
  - c. yes, viruses produce spores and can proliferate also outside the host cell
  - d. yes, they form infectious virions in proper conditions, which then attack the cells
70. Which of the following diseases are caused by viruses?
- a. flu
  - b. tonsillitis
  - c. tuberculosis
  - d. hepatitis
71. Oncoviruses cause:
- a. spots on the leaf surface
  - b. foot- and- mouth disease of livestock
  - c. formation of malignant tumors
  - d. uncontrolled cell division
72. Childhood illnesses caused by viruses are:
- a. flu
  - b. measles
  - c. chickenpox
  - d. jaundice
73. Which element is the important part of the chlorophyll?
- a. Fe
  - b. Mg
  - c. Ca
  - d. K
74. Which element is the important part of the haemoglobin?
- a. Na
  - b. Ca
  - c. Fe
  - d. K
75. What process is affected by inorganic salts within the cell?
- a. the homeostasis
  - b. the enzymatic regulation
  - c. the water regulation
  - d. the metabolism

76. Which of the following polysaccharides does have the structural function (within the cell)?

- a. saccharose
- b. cellulose
- c. glycogen
- d. chitine

77. Which of the following polysaccharides is the source of energy for a cell?

- a. glycogen
- b. glucose
- c. starch
- d. chitin

78. What organic molecules are the most common in cells?

- a. saccharides
- b. lipids
- c. proteins
- d. mineral substances

79. What organic molecules do store the greatest amount of energy?

- a. saccharides
- b. lipids
- c. proteins
- d. nucleic acids

80. What is the function of proteins within the cell?

- a. they provide support and structure for cells
- b. they store an energy
- c. they regulate the chemical reactions (processes) within the cell
- d. dissolved in water, they form the basic environment within the cell

81. Fibrous proteins have:

- a. mechanical function
- b. metabolic function
- c. immune function
- d. regulative function

82. Globular proteins have:

- a. metabolic function
- b. regulative function
- c. immune function
- d. mechanical function

83. How many amino acids do proteins of living organisms contain?

- a. 12
- b. 20
- c. 22
- d. 200

84. What organic substances do have the structural function?

- a. saccharides
- b. lipids
- c. proteins
- d. nucleic acids

85. Which organic substances can serve as the energy storage?

- a. saccharides
- b. lipids
- c. proteins
- d. nucleic acids

86. How do animals store the glucose (as an energy source)?

- a. as a starch
- b. as a cellulose
- c. as a glycogen
- d. as a lipid

87. What form are saccharides in the plant organism stored in, as an energy source?

- a. lipid
- b. starch
- c. glycogen
- d. cellulose

88. Lipids are involved in the regulation mechanisms within a cell as a part of:

- a. hormones
- b. vitamins
- c. chromosomes
- d. enzymes

89. Chromatin consists of:

- a. proteins and nucleic acid
- b. nucleic acid and saccharide
- c. protein and nuclein (dye)
- d. just nucleic acid

90. Nucleic acids can provide:

- a. coding of the genetic information
- b. transfer of the genetic information from parents to offspring
- c. metabolism regulation
- d. translation of the genetic information to the amino acids sequence

91. How many ATP molecules are produced during the anaerobic cleavage of 1 glucose molecule?

- a. 2
- b. 4
- c. 16
- d. 21

92. Which of the following organisms are eukaryotic?

- a. all multi-cellular and some of unicellular organisms
- b. just multi-cellular organisms
- c. all organisms with biological membranes
- d. bacteria and cyanobacteria

93. We can say about fungi cells:

- a. glycogen is their reserve substance
- b. their cell wall contains cellulose
- c. their cell wall contains chitin
- d. they are typical prokaryotic cells

94. We can say about plant cells:

- a. starch is their reserve substance
- b. their cell wall contains cellulose
- c. when they get older, they contain many vacuoles
- d. young cells contain many vacuoles

95. What is considered to be membrane structure of the cell?

- a. nucleus, plastids, mitochondria, endoplasmic reticulum
- b. plastids, vacuoles, ribosomes, endoplasmic reticulum
- c. chloroplasts, Golgi apparatus, mitochondria, lysosomes
- d. vacuoles, mitotic apparatus, ribosomes, lysosomes

96. Which of the following cells does have the cell wall?

- a. plant cell
- b. animal cell
- c. fungi cell
- d. bacteria cell

97. We can say about cell surfaces (according to the water and substances dissolved in the water):

- a. cell wall is permeable, cytoplasmic membrane is semipermeable
- b. cell wall is impermeable, cytoplasmic membrane is semipermeable
- c. cell wall is semipermeable, cytoplasmic membrane is impermeable
- d. the permeability of cell wall and cytoplasmic membrane is identical, it depends on the environment

98. Which synthesis does occur in the cell nucleus?

- a. of nucleic acids
- b. of lipids
- c. of proteins
- d. of saccharides

99. Where is DNA located within the cell?

- a. in chromosomes
- b. in nucleolus
- c. in plastids
- d. in ribosomes

100. Where is the mRNA synthesis located within the cell?

- a. in cytoplasm
- b. on ribosomes
- c. in nucleus
- d. in nucleolus

101. Phospholipids serve as structural parts of:

- a. biomembranes
- b. fibrous cellular structures
- c. chromosomes
- d. mitotic apparatus

102. Which of the following structures do have double cell membrane?

- a. nucleus, mitochondria, plastids
- b. nucleus, vacuoles, plastids
- c. just mitochondria and plastids
- d. just nucleus

103. What cell organelles are considered to be the energetic centre of the cell?

- a. chloroplasts, where the light energy is converted into the chemical energy
- b. mitochondria, because of the ATP formation
- c. endoplasmic reticulum, because it provides the synthesis of proteins and lipids
- d. nucleus, because it contains DNA and it is the main cell's control centre

104. We can say about mitochondria:

- a. they are the energetic centre of the cell
- b. they convert the energy to ATP during the respiration process
- c. there is only one mitochondrion in each cell
- d. there are hundreds or thousands of mitochondria in each cell

105. How many mitochondria are there in a cell?

- a. 1
- b. 2
- c. there may be hundreds of them within a single cell
- d. less than 100

106. Calvin-Benson cycle (carbon fixation) takes place in the:

- a. nucleus
- b. cytoplasm
- c. mitochondrial matrix
- d. stroma of chloroplasts

107. Where are leucoplasts located most often?

- a. in reserve organs of protozoans
- b. in reserve organs of plants
- c. in all of plant cells
- d. in leaf cells after chlorophyll loss

108. We can say about plastids:

- a. they are located only in plant cells
- b. they are located only in plant and animal cells
- c. most of them contain photosynthetic dyes
- d. they have their own DNA

109. We can say about endoplasmic reticulum:

- a. it is a membrane structure made of interconnected vesicles
- b. rough endoplasmic reticulum provides the synthesis of proteins
- c. smooth endoplasmic reticulum provides the synthesis of saccharides
- d. it provides the transport of substances

110. What is the rough endoplasmic reticulum covered with?

- a. nucleic acids
- b. lysosomes
- c. ribosomes
- d. enzymes

111. Where are proteins synthesized within the cell?

- a. nucleus, endoplasmic reticulum and ribosomes
- b. rough endoplasmic reticulum and Golgi apparatus
- c. free cytoplasm ribosomes and thylakoids
- d. endoplasmic reticulum, ribosomes and Golgi apparatus

112. What functions do vacuoles have in plant cells?

- a. they attend catabolic processes
- b. they are filled with reserve substances
- c. plant dyes are produced in here
- d. they determine the inner pressure of the cell

113. Is it truth, that vacuoles are present only in plant cells?

- a. yes, they are typical plant structures
- b. yes, similar animal structure are lysosomes
- c. no, some animal cells contain specialized vacuoles
- d. no, vacuoles are important structures of cells of protozoans

114. What do we consider to be nonliving component of the cell?

- a. starch grains
- b. lipid droplets
- c. inclusions
- d. cytoskeleton

115. Microfilaments are:

- a. thin filaments in cell cytoplasm, that provide the contraction
- b. tube like structures in the cytoplasm
- c. filaments of spindle apparatus
- d. fibrous structures

116. Microtubules are:

- a. fibrous structures
- b. thin filaments in cell cytoplasm, that provide the contraction
- c. tube like structures in the cytoplasm
- d. vesicles that formed the endoplasmic reticulum

117. Fibrous structures that are not able to contract are called:

- a. intercellular filaments
- b. intermediate filaments
- c. intermediate tubules
- d. intercellular tubules

118. The dynamic cell skeleton consists of:

- a. cytoskeleton
- b. cytoplasm
- c. system of crystalline inclusions
- d. network of microfilaments and microtubules

119. Which processes of substances passing through the cytoplasmic membrane do need the energy?

- a. osmosis
- b. active transport
- c. phagocytosis
- d. pinocytosis

120. Active transport across the cytoplasmic membrane is provided by:

- a. transport proteins
- b. phagocytosis
- c. pinocytosis
- d. diffusion

121. Diffusion is:

- a. the movement of molecules from an area of lower concentration towards an area of higher concentration
- b. substance dispersion in the solvent
- c. solvent dispersion in the substance
- d. the equalizing of the solvent and solution concentration along the concentration gradient

122. What is the example of diffusion within living organisms?

- a. oxygen passing from alveoli to the blood
- b. water absorption in the intestine
- c. water and minerals reabsorption in the nephron tubules
- d. carbon oxide passing from cells to the blood

123. The process of the absorption of lipids in the small intestine is provided by:

- a. osmosis
- b. pinocytosis
- c. phagocytosis
- d. protein canals

124. The transport of glucose and amino acids into the cell is provided by:

- a. pinocytosis
- b. phagocytosis
- c. transport protein
- d. ATP

125. The transport of important ions into the cell is provided by:

- a. diffusion
- b. osmosis
- c. endocytosis
- d. transport protein

126. During which process(es) is the cytoplasmic membrane rebuilt?

- a. exocytosis
- b. endocytosis
- c. pinocytosis
- d. phagocytosis

127. The osmosis is:

- a. the process of water passing through the semipermeable membrane towards an area of higher concentration of dissolved substance
- b. the movement of substance towards the solvent
- c. capillary inner pressure
- d. cellular inner pressure

128. Cell plasmolysis occurs in:

- a. hypotonic environment
- b. hypertonic environment
- c. environment with higher concentration of osmotically active substances
- d. environment with lower concentration of osmotically active substances

129. What can we observe, when we put salt on the cucumber:

- a. diffusion
- b. plasmolysis
- c. osmotic lysis
- d. plasmoptysis

130. When fruit skin ruptures after long lasting rains, what is it the consequence of?

- a. plasmolysis
- b. deplasmolysis
- c. plasmoptysis
- d. osmolysis

131. What medium does the osmotic lysis of red blood cells occur in?

- a. in salt solution
- b. in glucose solution
- c. in alcohol
- d. in distilled water

132. Concentration of the hypertonic environment is:

- a. unstable according to the environment
- b. higher than the concentration of substances dissolved in the cytoplasm
- c. identical to the concentration of substances dissolved in the cytoplasm
- d. lower than the concentration of substances dissolved in the cytoplasm

133. Concentration of the hypotonic environment is:

- a. identical to the concentration of substances dissolved in the cytoplasm
- b. unstable according to the environment
- c. higher than the concentration of substances dissolved in the cytoplasm
- d. lower than the concentration of substances dissolved in the cytoplasm

134. Concentration of the isotonic environment is:

- a. higher than the concentration of substances dissolved in the cytoplasm
- b. lower than the concentration of substances dissolved in the cytoplasm
- c. identical to the concentration of substances dissolved in the cytoplasm
- d. unstable according to the environment

135. In the hypotonic environment, the animal cell:

- a. takes in the water and ruptures (bursts)
- b. releases the water
- c. undergoes plasmolysis
- d. undergoes plasmoptysis

136. In what type of environment does the red blood cell shrink?

- a. hypotonic
- b. hypertonic
- c. isotonic
- d. in salt solution

137. Is it true that by the bacterial throat inflammation, the gargling with concentrated NaCl solution helps?

- a. yes, in the hypertonic environment bacteria release water and die
- b. yes, in the hypotonic environment bacteria take in the water and burst
- c. no, NaCl solution can damage the mucosa
- d. no, NaCl solution is harmless to bacteria

138. Pinocytosis:

- a. is the active form of substances transport across the cytoplasmic membrane
- b. is the passive form of substances transport across the cytoplasmic membrane
- c. provides the substances transport without the energy consumption
- d. provides the removal of useless substances from the cell

139. Which of the following processes must not be considered to be a passive transport across the cytoplasmic membrane?

- a. endocytosis
- b. pinocytosis
- c. osmosis
- d. phagocytosis

140. Which of the following processes must not be considered to be an active transport across the cytoplasmic membrane?

- a. diffusion
- b. pinocytosis
- c. phagocytosis
- d. osmosis

141. How many phases does the cell cycle have?

- a. 2
- b. 4
- c. 6
- d. 8

142. Which cell structure is responsible for the exact distribution of chromosomes into daughter cells?

- a. nucleus
- b. cytoskeleton
- c. mitochondria
- d. mitotic apparatus

143. The phase of the cell cycle, where microtubules of spindle apparatus shorten, and pull the chromosomes to the centrioles, is called:

- a. telophase
- b. interphase
- c. metaphase
- d. anaphase

144. Chromosomes are:

- a. morphological structures, that can be observed only during the cell division
- b. structures, that can be observed in the nucleus permanently
- c. structures, that can be observed only in S-phase of the cell cycle
- d. structures, that are formed in the nucleus at the beginning of the cell division

145. What type of cells does the mitosis give rise to?

- a. somatic cells
- b. cells of whole organism
- c. cells of all organisms, bacteria included
- d. only to gametes

146. What happens during prophase of mitosis?

- a. the chromosomes spiralization
- b. the synthesis of DNA
- c. the formation of mitotic apparatus
- d. the formation of nucleolus

147. What happens during metaphase of mitosis?

- a. chromosomes convene along the equatorial plane
- b. daughter chromatides diverge
- c. chromatids become separate
- d. centrioles diverge

148. What happens during anaphase of mitosis?

- a. chromosomes diverge to opposite ends of the cell
- b. chromatids diverge to opposite ends of the cell
- c. the nucleus division ends
- d. mitotic apparatus is eliminated

149. What happens during telophase of mitosis?

- a. the karyokinesis ends
- b. the cytokinesis is in progress
- c. the despiralization of chromosomes
- d. forming of new DNA

150. Which phase of cell cycle does the duplication of chromatides (single-chromatid chromosome becomes double-chromatid chromosome) occur in?

- a. metaphase
- b. prophase
- c. S-phase
- d. G<sub>2</sub>-phase

151. The reduction of the chromosome number is characteristic for:

- a. heterotypic cell division
- b. homotypic cell division
- c. I. meiotic division
- d. II. meiotic division

152 . We can say about heterotypic cell division:

- a. it is the first meiotic division
- b. it is the second meiotic division
- c. the chromosome number is reduced into a half
- d. the chromosome number does not change, this type of division is similar to mitosis

153. We can say about homotypic cell division:

- a. it is the first meiotic division
- b. it is the second meiotic division
- c. the chromosome number does not change, this type of division is similar to mitosis
- d. the chromosome number is reduced into a half

154. Karyokinesis:

- a. is the division of nucleus
- b. is the movement of the nucleus in the cytoplasm
- c. is the movement of centriols after the division
- d. is the movement of chromosomes in the anaphase

155. Cytokinesis is the process, by which:

- a. the cell division process after interphase begins
- b. the separating of bivalents begins
- c. the cell division process in the telophase ends
- d. the nucleus division process of the mitosis ends

156. Which phase of the mitosis do we observe if we can see double-chromatid chromosomes convened along the equatorial plane under the microscope?

- a. telophase
- b. metaphase
- c. cytokinesis
- d. anaphase

157. Which phase of the mitosis do we observe if we can see enlarged nuclei with visible

chromosomes under the microscope?

- a. interphase
- b. metaphase
- c. anaphase
- d. prophase

158. Centromere is:

- a. a part of the spindle apparatus
- b. a location of chromosomes crossing
- c. a place on the chromosome to which the filaments of the spindle apparatus connect
- d. a place on the chromosome where a gene is located

159. Meiosis is the process of:

- a. bacteria division
- b. reproduction of protozoans
- c. the reduction of the chromosome number to the half
- d. the reproduction of viruses

160. We can say about human karyotype:

- a. it is the chromosome map of one cell
- b. it is the set of chromosomes of somatic cell
- c. it consists of 23 chromosome pairs
- d. it is the set of chromosomes of gamete

161. Crossing-over is the process:

- a. of the reductional division of gamete
- b. where the recombination of genes between homologous chromosomes takes place
- c. of the formation of a new chromosome with recombined set of genes
- d. which occurs during the prophase of I. reductional division

162. What is the difference between the anaphase of the meiosis I and anaphase of the mitosis?

- a. during the meiosis, single-chromatid chromosomes diverge
- b. during the meiosis I, chromosomes stay in double-chromatid form
- c. in the anaphase of the meiosis, chromosomes do not become separate
- d. chromosomes of meiosis I despiralitate earlier

163. The chromosome map represents:

- a. relative mutual gene organization on chromosome
- b. order, mutual position and the specific location of genes on chromosome
- c. the set of all cell chromosomes
- d. the number and a shape of nucleotides in chromosome

164. How many chromosomes does the human cell have?

- a. 46
- b. 23 pairs
- c. 23 pairs of autosomes + 2 sex chromosomes
- d. 22 pairs of autosomes + 1 pair of heterochromosomes

165. How many chromosomes does the human cell have?

- a. 23
- b. 23 pairs
- c. 48
- d. 48 pairs

166. What is the genetic significance of meiosis?

- a. the reduction of the chromosome number to a half during the gamete production
- b. the random combination of parents chromosomes in gametes resulting in a higher genetic variability
- c. the possibility of the recombination (exchange of pieces) between homologous chromosomes resulting to higher genetic variability
- d. the exact distribution of genes to offspring cells leading to the conservation of genetic information

167. In the process of meiosis, the crossing-over may occur:

- a. only between homologous chromosomes
- b. also between nonhomologous chromosomes
- c. only in the interphase of cell cycle
- d. only in the prophase of the first meiotic division

168. We can say about homologous chromosomes:

- a. they have identical content, structure and shape
- b. they are paired chromosomes, one from mother, one from father
- c. it is the set of chromosomes from one parent
- d. they are sex chromosomes

169. Which intracellular structures do contain their own DNA?

- a. Golgi apparatus and mitochondria
- b. endoplasmic reticulum and vacuoles
- c. mitochondria and plastids
- d. plasmids and Golgi apparatus

170. Extranuclear heredity of animal cells is caused by the presence of:

- a. RNA in the cell cytoplasm
- b. DNA in the nucleolus
- c. DNA in chloroplasts
- d. DNA in mitochondria

171. Extranuclear heredity of plant cells is caused by the presence of:

- a. RNA in the cell cytoplasm and DNA in chloroplasts
- b. DNA in the nucleolus and in the cytoplasm
- c. DNA in chloroplasts and in mitochondria
- d. DNA in plastids

172. What types of RNA can we recognize in the organism?

- a. genome, messenger, transfer
- b. gene, transformational, messenger
- c. messenger, transfer, ribosomal
- d. translatory, single-stranded, double-stranded

173. Select correct pairs of complementary nitrogenous bases:

- a. A-T, C-G
- b. A-C, T-G
- c. A-U, G-C
- d. A-G, U-C

174. During the synthesis of DNA the adenine of one strand is attached to:

- a. cytosine of another
- b. guanine of another
- c. thymine of another
- d. uracil of another

175. During the synthesis of DNA the guanine of one strand is attached to:

- a. thymine of another
- b. uracil of another
- c. cytosine of another**
- d. adenine of another

176. During the synthesis of DNA the cytosine of one strand is attached to:

- a. uracil of another
- b. adenine of another
- c. guanine of another**
- d. thymine of another

177. During the synthesis of DNA the thymine of one strand is attached to:

- a. cytosine of another
- b. guanine of another
- c. adenine of another**
- d. uracil of another

178. Which nucleotide is present in the RNA instead of thymine?

- a. guanine
- b. uracil**
- c. cytosine
- d. adenine

179. How many nucleotides are there in the codon?

- a. 2
- b. 3**
- c. 4
- d. 5

180. How many STOP codons are there in the genetic code?

- a. 1
- b. 2
- c. 3**
- d. 4

181. How many start codons are there in the genetic code?

- a. 1**
- b. 2
- c. 3
- d. 4

182. In a process of the expression of genetic code, there is the only one start codon:

- a. AUG**
- b. AGU
- c. UAG
- d. GUA

183. One strand of DNA has the following sequence of nucleotides A-C-G-G-T-A.  
What is the sequence of the other DNA strand?
- a. G-T-C-C-A-G
  - b. T-G-C-C-A-T**
  - c. U-G-C-C-A-U
  - d. T-G-C-C-U-T
184. What is the sequence of the other strand after the replication of DNA with the sequence  
C-G-T-G-C-A?
- a. A-T-C-T-A-G
  - b. G-C-A-C-G-U
  - c. G-C-A-C-G-T**
  - d. G-C-U-C-G-T
185. What is the sequence of nucleotides of the RNA strand that was formed according to the A-G-C-G-G-T matrix?
- a. T-C-G-C-C-A
  - b. U-C-G-C-C-A**
  - c. U-C-G-C-C-U
  - d. T-C-G-C-C-U
186. What is the difference between nucleotides of DNA and RNA?
- a. DNA contains a pentose (deoxyribose) and RNA contains a hexose (ribose)
  - b. DNA contains a pentose (deoxyribose) and RNA contains pentose (ribose)**
  - c. DNA contains thymine and RNA contains uracil**
  - d. adenine is complementary to uracil in DNA, but in RNA it is complementary to thymine
187. According to what principle is the new strand of DNA or RNA formed?
- a. complementarity**
  - b. combinatorics
  - c. independency
  - d. statistics
188. Which nitrogenous bases are present in DNA and RNA as well?
- a. thymine, guanine, adenine
  - b. guanine, adenine, cytosine**
  - c. adenine, cytosine, uracil
  - d. uracil, guanine, cytosine
189. What nitrogenous bases do DNA and RNA differ in?
- a. adenine and guanine
  - b. thymine and cytosine
  - c. cytosine and uracil
  - d. thymine and uracil**

190. What is formed during the translation?

- a. mRNA according to the DNA matrices
- b. tRNA according to the mRNA matrices
- c. protein according to the mRNA matrices
- d. protein according to the t RNA matrices

191. What is synthesized during the translation?

- a. protein according to the tRNA matrices
- b. tRNA according to the mRNA matrices
- c. mRNA according to the DNA matrices
- d. protein according to the mRNA matrices

192. The central dogma of molecular biology says that transfer of genetic information at the cellular level runs in one direction and:

- a. consists of three processes – replication – transcription – translation
- b. consists of three processes – replication – translation – transcription
- c. consists of two processes – from DNA to RNA and from RNA to protein
- d. consists of two processes – transcription – translation

193. What will be the sequence of nucleotides in anticodon, when the sequence of nucleotides in codon is A-U-G?

- a. C-A-U
- b. U-A-C
- c. U-T-C
- d. G-A-C

194. What happens during the replication?

- a. duplication of the genetic information
- b. synthesis of DNA molecule
- c. formation of two identical DNA molecules
- d. formation of mRNA

195. The process during which the duplication of genetic information occurs is known as?

- a. replication
- b. transcription
- c. duplication
- d. translation

196. The process during which the transfer of genetic information from DNA to mRNA occurs is known as?

- a. replication
- b. transcription
- c. duplication
- d. translation

197. The process during which the transfer of genetic information from nucleic acid to protein occurs is known as:

- a. replication
- b. transcription
- c. duplication
- d. translation

198. When does the replication of DNA occur in a cell?

- a. continuously
- b. only in the S-phase of the cell cycle
- c. only in the M-phase
- d. only during the meiosis

199. What happens during the transcription?

- a. synthesis of DNA molecule
- b. synthesis of RNA molecule according to the DNA matrix
- c. copying of genetic information from DNA to mRNA
- d. translation of genetic information from mRNA to sequence of amino acids

200. Transcription refers to:

- a. RNA synthesis according to a DNA matrix
- b. protein synthesis according to an m-RNA matrix
- c. process of transcription of genetic information from DNA to RNA
- d. process of transcription of genetic information from codon to anticodon

201. Translation means:

- a. translation of genetic information from the sequence of nucleotides to the sequence of amino acids
- b. protein synthesis
- c. synthesis of m-RNA
- d. transcription of genetic information from DNA to RNA

202. Translation means:

- a. transcription of genetic information from DNA to m-RNA
- b. process of protein synthesis as the end of gene expression
- c. translation of genetic information from m-RNA into polypeptide chain
- d. translation of genetic information from the sequence of nucleotides into the sequence of amino acids

203. Why is the genetic code described as degenerative?

- a. different codons can specify the same amino acid
- b. the genetic code is mutated
- c. one codon specifies always just one amino acid
- d. each triplet consists of three nucleotides

204. Prokaryotic organisms genetic material consists of:

- a. one circular RNA molecule
- b. several single stranded DNA molecules
- c. single stranded DNA molecule
- d. double stranded circular DNA molecule, stabilized by proteins

205. Plasmids are:

- a. single stranded forms of RNA in bacteria
- b. linear forms of DNA in bacteria
- c. circular forms of RNA in eukaryotic cells
- d. circular DNA molecules in bacteria

206. The basic laws of heredity were discovered by Mendel when cross-pollinating:

- a. peas
- b. roses
- c. corn
- d. beans

207. Mendel's laws of heredity are valid only if:

- a. a single gene is encoding a single trait
- b. the parents are homozygotes, one of them is dominant, the other is recessive
- c. it is an autosomal heredity
- d. when observing several traits concurrently each gene is located on a different chromosome

208. Allele is:

- a. mutation of a gene
- b. particular form of a gene
- c. deletion of a gene
- d. insertion in the gene

209. What kinds of correlations of alleles can happen in a zygote?

- a. dominance
- b. recessivity
- c. codominance
- d. heterocodominance

210. Heterozygote is individual:

- a. with male or female sex distinguished
- b. with two different alleles for certain trait
- c. with two or more genes for certain trait
- d. with different chromosomes in pairs

211. What is the heredity with complete dominance?

- a. when both alleles in gene are dominant
- b. when in the phenotype of heterozygote, only the dominant allele is expressed
- c. when no recessive trait emerges
- d. when two dominant alleles are in the genotype of heterozygote

212. If in the phenotype of a heterozygote, only the dominant allele is expressed, we can speak about:

- a. intermediate inheritance
- b. heredity with complete dominance
- c. heredity with incomplete dominance
- d. nonhomologous heredity

213. What is the heredity with incomplete dominance?

- a. when no recessive trait emerges in population
- b. when dominant and recessive alleles are present in the genotype of heterozygote
- c. when in the phenotype of heterozygote the dominant allele as well as recessive one is expressed
- d. when in the phenotype of heterozygote both alleles are expressed

214. If in the phenotype of a heterozygote both alleles for certain trait are expressed, we can speak about:

- a. double heredity
- b. mixed heredity
- c. heredity with incomplete dominance
- d. intermediate inheritance

215. How can we write down the cross of homozygous dominant individual with heterozygous individual?

- a.  $aa \times Aa$
- b.  $AA \times AB$
- c.  $AA \times Aa$
- d.  $AA \times ab$

216. How can we write down the cross of homozygous recessive individual with heterozygous individual?

- a.  $aa \times ab$
- b.  $aa \times Aa$
- c.  $AA \times Aa$
- d.  $AA \times AB$

217. Select the scheme(s) of the cross of homozygous dominant individual with heterozygous individual:

- a.  $AA \times Aa$
- b.  $AA \times AB$
- c.  $Aa \times ab$
- d.  $AABB \times AaBb$

218. Select the scheme(s) of the cross of heterozygous individual and homozygous recessive individual:

- a.  $AB \times aa$
- b.  $Aa \times ab$
- c.  $Aa \times aa$
- d.  $AaBb \times aabb$

219. Select the scheme of the cross of two heterozygous individuals:

- a. AA x BB
- b. Aa x Aa
- c. Aa x Bb
- d. AaBb x AaBb

220. Genotypic and phenotypic cross ratios differ when:

- a. we speak about heredity with complete dominance
- b. we speak about heredity with incomplete dominance
- c. we speak about intermediate inheritance
- d. they always differ

221. Genotypic and phenotypic cross ratios are identical when:

- a. we speak about heredity with complete dominance
- b. we speak about heredity with incomplete dominance
- c. we speak about dihybridism
- d. they always differ

222. Backcross (test cross) is the cross of:

- a. two homozygous individuals
- b. two heterozygous individuals
- c. homozygous dominant individual and heterozygous individual
- d. homozygous recessive individual and heterozygous individual

223. Red colour of flowers is completely dominant to white colour. What colour of flowers will the generation of hybrids have if white-flowered plants are crossed with red-flowered heterozygous plants?

- a. only red
- b. only white
- c. pink
- d. white or red

224. Red colour of flowers is completely dominant to white colour. What colour of flowers will the generation of hybrids have if white-flowered plants are crossed with red-flowered homozygous plants?

- a. only red
- b. only white
- c. only pink
- d. white or red

225. Red colour of flowers is completely dominant to white colour. What colour of flowers will the generation derived from red-flowered heterozygous plants have?

- a. red and white in the ratio 3:1
- b. red and white in the ratio 1:1
- c. red, pink and white in the ratio 1:2:1
- d. only red

226. Red colour of flowers is incompletely dominant to white colour. What colour of flowers will the generation of hybrids have if white-flowered plants are crossed with heterozygous plants?

- a. 100% pink
- b. red and white in the ratio 1:1
- c. red, pink and white in the ratio 1:2:1
- d. white and pink in the ratio 1:1

227. Red colour of flowers is incompletely dominant to white colour. What colour of flowers will the generation of hybrids have if white-flowered plants are crossed with red-flowered plants?

- a. only red
- b. only white
- c. only pink
- d. white or red

228. Red colour of flowers is incompletely dominant to white colour. What colour of flowers will the generation derived from heterozygous plants have?

- a. red and white in the ratio 3:1
- b. red and white in the ratio 1:1
- c. red, pink and white in the ratio 1:2:1
- d. only red

229. Who did discover the role the chromosomes play in heredity?

- a. J. G. Mendel
- b. J. Watson
- c. T. H. Morgan
- d. G. H. Hardy

230. When we speak about dihybridism, how can we write down the scheme of the cross of homozygous dominant (for both traits) with homozygous recessive (for both traits) parent?

- a. AB x ab
- b. AABB x aabb
- c. AA x bb
- d. AA x BB

231. When we speak about dihybridism, how can we write down the scheme of a cross of two heterozygous parents (for both traits)?

- a. AB x ab
- b. Ab x Ab
- c. AABB x AAbb
- d. AaBb x AaBb

232. When we speak about dihybridism, what alleles are formed by the individual, who is heterozygous for both traits?

- a. AB, Ab, aB, ab
- b. AB, ab
- c. AA, aa, BB, bb
- d. A, a, B, b

233. What is the number of recessive homozygotes in a panmictic population?

- a.  $p \times p$
- b.  $p^2$
- c.  $2pq$
- d.  $q^2$

234. What is the number of heterozygotes in a panmictic population?

- a.  $pq^2$
- b.  $p + q$
- c.  $(p \times q) + (p \times q)$
- d.  $2pq$

235. What is the equation for the frequency of all genotypes in panmictic population?

- a.  $p^2 + 2pq + q^2 = 1$
- b.  $p + q = 1$
- c.  $p^2 + q^2 = 1$
- d.  $p^2 \times q^2 = 1$

236. If the gene has only two alternative forms, what is the equation of the frequency of alleles in the panmictic population?

- a.  $p^2 + 2pq + q^2 = 1$
- b.  $p + q = 1$
- c.  $p^2 + q^2 = 1$
- d.  $p^2 \times q^2 = 1$

237. Frequency of the dominant allele "A" is 50% and frequency of the recessive allele "a" is 50% in the population. What is the percentage of recessive homozygotes "aa" in this population?

- a. 25%
- b. 50%
- c. 0.5
- d. 0.25

238. Frequency of the dominant allele "A" is 50% and frequency of the recessive allele "a" is 50% in the population. What is the percentage of dominant homozygotes "AA" in this population?

- a. 25%
- b. 0.25
- c. 50%
- d. 0.5

239. Frequency of the dominant allele "A" is 50% and frequency of the recessive allele "a" is 50% in the population. What is the percentage of heterozygotes "Aa" in this population?

- a. 25%
- b. 0.25
- c. 50%
- d. 0.5

240. 25% of population members carry the recessive trait. What is the frequency of members carrying the dominant trait in this population?

- a. 75%
- b. 50%
- c. 0.75
- d. 0.25

241. Polygenic system consists of:

- a. neutral and recessive alleles
- b. quantitative alleles
- c. genes of small and large effect
- d. genes of small effect

242. Phenotype of quantitative traits is the result of:

- a. the combination of genotype and the environment effect
- b. the combination of genes of small effect and large effect
- c. the variability of polygenic system
- d. the sum of neutral and active alleles and the environment effect

243. Heritability is:

- a. the proportion of observable differences in a trait (quantitative) between individuals within a population that is due to genetic differences
- b. the relationship between neutral and active alleles
- c. the proportion of quantitative traits in the phenotype
- d. relationship between genotype and phenotype

244. What does it mean if the heritability quotient for human height is  $h^2 = 0.7$ ?

- a. dependence of human height on genotype is 70%, and on environment 30%
- b. 70% of alleles for human height is active and 30% is neutral
- c. human height is quantitative trait
- d. phenotypic variability of human height is 30%

245. What does it mean if the heritability quotient is  $h^2 = 0$ ?

- a. this trait does not depend on genotype
- b. it is the qualitative trait
- c. the trait depends only on environment
- d. the trait depends only on heredity

246. What does it mean if the heritability quotient is  $h^2 = 1$ ?

- a. this trait does not depend on genotype
- b. it is the quantitative trait
- c. the trait depends only on environment
- d. the trait depends only on genotype

247. Is it true that all mammal females do have mammary glands in common?

- a. yes, they produce milk, the basic nourishment for young offspring
- b. yes, but not all mammal females do have nipples
- c. no, egg laying mammals do not have lactic glands
- d. no, all mammals have the fur and female nipples (lactic) in common

248. What is a meaning of the formation of septa in heart during the evolution?

- a. it gave rise to small circulation, so the blood could get from lungs to the heart faster
- b. the blood circulation could be regulated better by heart valves
- c. oxygenated and deoxygenated blood was separated, so the efficiency of the use of oxygen increased
- d. simultaneously with increased blood volume in the heart of terrestrial animals, the blood pressure has been decreased

249. Is it true that herbivores do have more complex digestive system than carnivores do?

- a. no, the structure of digestive system depends on evolutionary level of an animal
- b. no, more complex digestive system is characteristic for carnivores, because meat food is more difficult to be digested
- c. yes, herbivore's stomach consists of 4 chambers and their intestine is longer
- d. yes, plants food is more difficult to be digested

250. Which animals do have amniotic sac, that protects the foetus?

- a. all of vertebrates
- b. just mammals
- c. egg laying animals
- d. terrestrial vertebrates

251. Vertebrates are characteristic by lactation and nourishing of young offspring. Is it true that all vertebrates do have lactic glands?

- a. no, they are not developed among egg laying mammals
- b. no, they are characteristic for placental mammals
- c. yes, but there is a difference in the development of nipples (lactic)
- d. yes, but egg laying mammals do not produce milk

252. What are basic types of animal tissues?

- a. epithelial, connective, muscle, nervous
- b. epithelial, osseous, muscle, nervous, blood
- c. epithelial, connective, chondral, osseous, blood, nervous, muscle
- d. squamous, osseous, chondral, muscle, nervous

253. Ciliated epithelium of human body:

- a. occurs in upper respiratory tract
- b. occurs in oviducts
- c. is located to three places in woman's body
- d. occurs in the organ of Corti

254. What is the characteristic feature of epithelia?

- a. stratified cell organization
- b. nourishment of upper cell levels is supplied by lower cell levels
- c. there is a lot of intercellular space
- d. they contain very little of intercellular matrix

255. Which of the following options represents the real epithelium type?

- a. absorptive
- b. adipose
- c. fibrous
- d. ciliated

256. What types of muscle tissue do we know?

- a. striated (excluding cardiac) and smooth
- b. striated, smooth and cardiac
- c. striated, involuntary and cardiac
- d. skeletal and smooth

257. Skeletal muscle cell:

- a. has the only one nucleus
- b. has more nuclei
- c. does not have the nucleus
- d. does not have mitochondria

258. Cardiac muscle is (according to the structure):

- a. striated, identical to skeletal
- b. a specific type of striated muscle
- c. the combination of skeletal and smooth muscle
- d. smooth with more nuclei

259. Which of the following options is considered to be the set of supporting tissues?

- a. connective tissue, cartilage, bone
- b. bone, collagen, periosteum
- c. epithelium, connective tissue, cartilage
- d. periosteum, collagen, connective tissue

260. What does the absorptive epithelium provide?

- a. substances uptake
- b. absorption
- c. excretion
- d. protection

261. What do glandular epithelium cells provide?

- a. absorption
- b. secretion
- c. excretion
- d. substances uptake

262. What types of epithelia can be found in the digestive system of human body?

- a. tectorial
- b. glandular
- c. absorptive
- d. sensory

263. What type of epithelium does occur in respiratory tract?

- a. respiratory epithelium
- b. ciliated epithelium
- c. mucin
- d. absorptive epithelium

264. Which of the following options does provide the ability of contraction of muscle cells?

- a. actin and myosin
- b. nervimuscular junction
- c. nerve fibres
- d. myofibrils

265. Smooth muscles form the locomotion system of:

- a. all protostomes
- b. flat worms, roundworms, annelids (ring worms) and molluscs
- c. flat worms and roundworms only
- d. protostomes, echinoderms and tunicates

266. Striated (skeletal) muscles form the locomotion system of:

- a. arthropods and vertebrates
- b. vertebrates only
- c. molluscs, arthropods and vertebrates
- d. terrestrial animals

267. What fibres do form the striate muscle?

- a. mononuclear fibres
- b. multinuclear fibres
- c. nonnuclear fibres
- d. fibres that originated from the fusion of several cells

268. How many muscle fibres are there in the striated muscle (skeletal) fascicle?

- a. 10 – 100
- b. no more than 10
- c. several hundreds
- d. more than 1000

269. How do we call the state of muscle tension?

- a. muscle contraction
- b. muscle cramp
- c. muscle tone
- d. muscle excitability

270. Tendons and protective capsules of vital organs consist of:

- a. cartilage
- b. connection tissue
- c. epithelium
- d. tissue

271. Cartilage occurs:

- a. in intervertebral discs
- b. on the surface of bones
- c. in an epiglottis
- d. in teeth

272. Periosteum provides:

- a. protection as a bone capsule composed of connective tissue
- b. bone thickening and regeneration
- c. blood cells production
- d. the nourishment supply for the bone

273. Spongy osseous tissue occurs:

- a. in flat bones
- b. in the middle of long bones
- c. in heads of long bones
- d. on the surface of bones

274. We can say about bone marrow:

- a. when young, it is red, by ageing turns yellow
- b. it provides haematopoiesis in all bones during lifetime
- c. during adulthood, it provides haematopoiesis in certain bones
- d. it nourishes the bone

275. What has to be joined if we speak about complex joints?

- a. 2 bones by connective tissue
- b. 3 and more bones
- c. at least 4 bones
- d. bones and tendons

276. What is the most complex joint in human body?

- a. elbow joint
- b. hip joint
- c. neck joint
- d. knee joint

277. How are bones connected to each other, besides the joints?
- by epithelial tissue
  - by fibrous connective tissue
  - by osseous tissue
  - by cartilage
278. What parts of long bones do we distinguish?
- the middle part- diaphysis
  - expanded joint ends – epiphysis
  - growth plates – hypophysis
  - upper and lower parts – paralysis
279. How many bones does the adult human skeleton consist of?
- 103
  - 206
  - 312
  - 316
280. Which bones do form the neurocranium (brain case)?
- occipital, zygomatic, temporal, parietal, frontal
  - occipital, sphenoid, temporal, parietal, frontal
  - occipital, sphenoid, zygomatic, frontal
  - temporal, palate, parietal, zygomatic
281. Which bones do form the splanchnocranium (facial skeleton)?
- vomer
  - lacrima
  - sphenoid
  - zygomatic
282. Girdle of the upper limb consists of:
- humerus and scapula
  - sternum (breastbone) and humerus
  - clavicle and scapula
  - clavicle and sternum
283. Girdle of the lower limb (pelvic girdle) consists of:
- 2 pelvic bones and sacrum
  - 2 pelvic bones, pubic bone and sacrum
  - 1 pelvic bone, pubic bone and coccyx
  - 1 pelvic bone, sacrum and pubic bone
284. How many vertebrae does the backbone (spine) consist of?
- 5 cervical, 12 thoracic, 5 lumbar, 7 sacral and 4-5 coccygeal
  - 7 cervical, 12 thoracic, 5 lumbar, 5 sacral and 4-5 coccygeal
  - 7 cervical, 12 thoracic, 7 lumbar, 5 sacral and 4-5 coccygeal
  - 5 cervical, 7 thoracic, 5 lumbar, 5 sacral and 4-5 coccygeal

285. Rib (thoracic) cage consists of:

- a. 12 thoracic vertebrae, 12 rib pairs and sternum (breast bone)
- b. 12 rib pairs, sternum (breast bone) and 1 pair of scapulae
- c. 12 pairs of thoracic vertebrae, sternum (breast bone) and 12 ribs
- d. 12 rib pairs, diaphragm and sternum (breast bone)

286. Which vertebrae are fused in adults?

- a. sacral and coccygeal
- b. lumbar and sacral
- c. iliac, ischiac and pubic
- d. sacral and pelvic

287. What bones is the hand consisted of?

- a. 7 carpal bones, 5 metacarpal bones and 15 phalanges
- b. 8 carpal bones, 5 metacarpal bones and 14 phalanges
- c. 8 carpal bones, 4 metacarpal bones and 14 phalanges
- d. 7 carpal bones, 4 metacarpal bones and 12 phalanges

288. Pelvis consists of 3 individual bones:

- a. pubic bone, ischium and sacrum
- b. ischium, sacrum and ilium
- c. ischium, pubic bone and ilium
- d. pubic bone, ilium and sacrum

289. Which spinal curvature may cause health problems?

- a. kyphosis
- b. scoliosis
- c. osteoporosis
- d. lordosis

290. Diaphysis is:

- a. the middle part of long bone
- b. the head of long bone
- c. the growth plate
- d. the inner part of bone

291. Epiphysis is:

- a. the head of the joint of long bone
- b. the middle part of long bone
- c. the sigmoid curvature of the spine
- d. the spot of connection of two bones

292. Knee joint consists of:

- a. femur
- b. fibula
- c. tibia
- d. patella (knee cap)

293. Which bone does not form the knee joint?

- a. femur
- b. fibula
- c. radius
- d. tibia

294. Meniscus is:

- a. the tendon that tightens the calf muscle to the heel
- b. the connective tissue in the knee joint
- c. is scientific term for knee cap
- d. semilunar cartilage between femur and tibia

295. How is the disease resulting to bones getting thin called?

- a. rachitis
- b. osteoporosis
- c. lordosis
- d. scoliosis

296. What is connected by the connective tissue?

- a. flat bones of the skull
- b. teeth and dental alveoli in lower and upper jaw
- c. bones of pelvis
- d. ribs and sternum (breast bone)

297. What is connected by a cartilage?

- a. ribs and sternum (breast bone)
- b. vertebrae of sacrum and coccyx
- c. bodies of vertebrae
- d. bones of girdles (lower and upper)

298. What is the difference between atlas (vertebra) and other vertebrae?

- a. it does not have a body
- b. it is formed only by the anterior and posterior arch
- c. its body is projected into the dens, by which it is connected with axis (vertebra)
- d. there is a fossette (for axis dens) in the anterior arch

299. What is the difference between axis (vertebra) and other vertebrae?

- a. there is a fossette (for axis dens) in the anterior arch
- b. its body is projected into the dens, by which it is connected with atlas (vertebra)
- c. it is formed only by the anterior and posterior arch
- d. it does not have a body

300. Osteoporosis is disease resulting in:

- a. periosteum damage
- b. the higher risk of fracture
- c. the low bone density
- d. the knee joint abrasion

301. How many skeletal muscles are there (approximately) in the human body?
- a. 300
  - b. 400
  - c. 600
  - d. 800
302. What percentage of total body mass do muscles form?
- a. 36% (men)
  - b. 32% (women)
  - c. 36% (both sexes)
  - d. 30% (both sexes)
303. What does it mean if we say that muscles are antagonistic to each other?
- a. one acts against the other
  - b. if one is contracted, the other is relaxed
  - c. they cooperate
  - d. they are complementary
304. What does it mean if we say that muscles are synergic to each other?
- a. they are complementary during their motion
  - b. one acts against the other
  - c. their interaction is not possible
  - d. they work co-ordinately
305. What muscles are used for the facial (mood) expression?
- a. just mimic
  - b. just masticatory
  - c. mimic together with masticatory
  - d. mimic and cervical
306. Trapezius muscle provides:
- a. the position of scapula
  - b. movements of upper limb
  - c. the movement of knee joint
  - d. breathing movements
307. Achilles tendon attaches:
- a. calf muscle to knee
  - b. sartorius muscle to the tibia
  - c. calf muscle to calcaneus (heel bone)
  - d. straight muscle of thigh (rectus femoris muscle) to calcaneus (heel bone)
308. What is the longest muscle in the human body?
- a. quadriceps femori muscle
  - b. sartorius muscle
  - c. triceps surae muscle (calf muscle)
  - d. deltoid muscle

309. What does the "muscle tonus" mean?

- a. the state of residual muscle tension
- b. process of muscle contraction
- c. muscle tiredness (muscle fever)
- d. the state by which the metabolites are cumulated in muscles

310. What is the role of supra- and subhyoid muscles?

- a. they assist in mastication and swallowing
- b. they assist in eye moving
- c. they assist in coordinated tongue moving
- d. they assist in holding the head in the upright position

311. Trunk muscles consist of:

- a. back muscle group, chest muscle group, abdomen muscle group and pelvic floor muscle group
- b. chest muscle group and abdomen muscle group
- c. back muscle group and chest muscle group
- d. back muscle group, chest muscle group and abdomen muscle group

312. What muscles do belong to the surface back muscle group?

- a. trapezoid muscle
- b. latissimus dorsi muscle
- c. deltoid muscle
- d. rotatores muscles

313. What are the major muscles that control inhaling?

- a. external intercostal muscles
- b. internal intercostal muscles
- c. diaphragm
- d. abdominal muscles

314. What are muscles that control exhaling?

- a. diaphragm
- b. external intercostal muscles
- c. abdominal muscles
- d. internal intercostal muscles

315. We can say about diaphragm:

- a. it separates the chest and abdominal cavity
- b. it separates the abdominal cavity and pelvic floor muscles
- c. its movement downward helps the exhalation
- d. its movement upward helps the inhalation

316. What do abdominal muscles provide?

- a. they form the abdominal press
- b. they help to defecate
- c. they help to empty the bladder
- d. they help to inhale

317. We can say about deltoid muscle:

- a. it belongs to the pelvic floor muscle group
- b. it belongs to the back muscle group
- c. it forms the upper limb girdle
- d. it helps to stretch arms sideways

318. We can say about sartorius muscle:

- a. it belongs to the anterior femur muscle group
- b. it is the flexor of femur
- c. it is the extensor of femur
- d. it is quadriceps

319. What morphological parts can we recognize on muscle?

- a. head, belly and a tail
- b. head and body
- c. body and projection
- d. body, fascicles and muscle fiber

320. What is the functional element of locomotion system?

- a. interconnection of muscle and bone
- b. nervimuscular junction
- c. motor unit (interconnection between nerve and muscle)
- d. myofibrile

321. The main energy source for the muscle contraction is:

- a. sugar (saccharide)
- b. protein
- c. lipid
- d. nucleic acid

322. What is formed by the muscle contraction?

- a. nervimuscular junction
- b. myoglobin
- c. musculin
- d. actin-myosin complex

323. What basic proteins do myofilaments (muscle fibers) contain?

- a. actin and proline
- b. myosin and arginine
- c. actin, arginine and proline
- d. actin and myosin

324. Muscle fever originates from:

- a. the metabolites cumulation in muscle fibres
- b. the deficiency of oxygen
- c. the formation of actin-myosin complex failure
- d. the muscle tiredness

325. How many primary teeth (milk teeth; deciduous teeth) does human have?

- a. 32
- b. 20
- c. 14
- d. 24

326. What teeth are never included in primary teeth (milk teeth; deciduous teeth)?

- a. canines
- b. premolars
- c. molars
- d. incisors

327. What teeth are included in primary teeth (milk teeth; deciduous teeth)?

- a. 4 incisors, 8 molars, 4 premolars
- b. 8 incisors, 2 canines, 6 molars
- c. 8 incisors, 4 canines, 8 molars
- d. 4 incisors, 8 canines, 8 molars

328. Peristaltic contractions are:

- a. contractions of esophagus wall that propel food from esophagus towards the stomach
- b. reflex contractions during the food swallowing
- c. contractions of stomach wall as a result of the defensive mechanism causing vomiting
- d. contractions of stomach wall providing the food mixing

329. Which of salivary glands are be considered to be large salivary glands?

- a. subhyoid, submandibular, parotid
- b. sublingual, submandibular, parotid
- c. submandibular, submaxillary, parotid
- d. parotid, suhyoid, maxillary

330. Saliva contains:

- a. ptyalline
- b. chymosine
- c. amylases
- d. lysozyme

331. Is it true that in buccal (oral) cavity the absorption takes place?

- a. no, only mechanical and chemical digestion take place here
- b. no, the very beginning place of absorption is the stomach
- c. yes, the saccharides absorption starts here
- d. yes, some poisons and drugs are absorbed here

332. What is the name of the flap that encloses the entrance of the larynx during swallowing?

- a. epiglottis
- b. hyoid bone
- c. pharynx
- d. esophagus

333. What is the average stomach volume of adult human?

- a. 0.5 – 1l
- b. 1 – 2l
- c. 2 – 3l
- d. 3 – 5l

334. What is stomach wall consisted of?

- a. mucosa and 3 layers of smooth muscle
- b. mucosa, submucosa, smooth muscle and cartilage cover
- c. mucosa, submucosa and 3 layers of smooth muscle
- d. 3 layers of muscle covered with mucosa

335. Mucin is:

- a. protective layer of stomach wall formed by connective tissue
- b. alkaline (basic) mucus
- c. contained in gastric juice
- d. the activator of pepsinogen

336. What role does the hydrochloric acid play in digestion?

- a. it activates the inactive pepsinogen
- b. it modifies minerals substances chemically
- c. it prevents the C vitamin destroying
- d. it prevents B vitamin group destroying

337. What enzymes are secreted by stomach mucosa?

- a. pepsin, chymosine and lipase
- b. pepsin, mucin and HCl
- c. lipase, amylase and pepsin
- d. mucin, pepsin, lipase and chymosin

338. Which of the following ducts (veins, arteries) does enter the duodenum?

- a. common bile duct
- b. pancreatic duct
- c. portal vein
- d. hepatic artery

339. The most intense absorption occurs in:

- a. stomach
- b. large intestine
- c. pancreas
- d. small intestine

340. What is the most important organ of absorption in vertebrates?

- a. large intestine
- b. small intestine
- c. buccal cavity
- d. rectum

341. The digestive gland(s) is:

- a. villi and microvilli
- b. liver
- c. gall bladder
- d. salivary glands

342. We can say about bile:

- a. it is produced by liver
- b. it is produced by gall bladder
- c. it emulsifies fats and helps their digestion
- d. it contains the lipase (enzyme)

343. Gall bladder provides:

- a. the bile production
- b. the lipase production
- c. the bile storage
- d. the bile decomposition

344. What enzyme is present in saliva of vertebrates?

- a. trypsin
- b. trypsinogen
- c. lipase
- d. amylase

345. What enzymes are involved in saccharide digestion?

- a. ptyaline
- b. lipase
- c. chymosin
- d. amylase

346. What part of digestive tract does the saccharide digestion start in?

- a. buccal cavity
- b. stomach
- c. duodenum
- d. small intestine

347. What parts of digestive tract does the carbohydrates digestion occur in?

- a. buccal (oral) cavity
- b. stomach
- c. duodenum
- d. pancreas

348. Which enzymes are involved in protein digestion?

- a. pepsin
- b. trypsin
- c. mucin
- d. lysozyme

349. What parts of digestive tract does the protein digestion occur in?

- a. buccal cavity
- b. stomach
- c. liver
- d. duodenum

350. What is the function of HCl in the gastric juice?

- a. it activates pepsinogen
- b. it prevents the destroying of B and C vitamins
- c. it protects the stomach wall against self-digestion
- d. it destroys pathogenic microorganisms

351. What is the function of mucin in the digestive system?

- a. it activates pepsin together with HCl
- b. it protects the mucosa against the effect of pepsin and HCl
- c. it breaks down proteins
- d. it is effective against bacteria

352. What is gastric juice consisted of?

- a. HCl, pepsin, trypsin, mucin
- b. mucin, HCl, pepsin, lysozyme
- c. HCl, pepsin, mucin
- d. pepsin, amylase, ptyaline

353. What enzymes does the gastric juice contain?

- a. pepsin, lipase, chymosin
- b. pepsin, mucin, ptyaline
- c. chymosin, mucin, pepsin
- d. amylase, lipase, trypsin

354. What is the largest gland in the human body?

- a. pancreas
- b. thyroid gland
- c. parotid salivary gland
- d. liver

355. Which parts is small intestine consisted of?

- a. duodenum
- b. jejunum
- c. pancreas
- d. ileum

356. What parts of digestive tract does the fat digestion occur in?
- a. buccal (oral) cavity
  - b. stomach
  - c. small intestine
  - d. large intestine
357. What is the role of chymosin (enzyme) in digestion?
- a. it helps to curdle the milk (by infants)
  - b. it breaks down fats
  - c. it helps to digest carbohydrates
  - d. it activates pepsinogen
358. What enzymes are important in fat digestion?
- a. bile
  - b. lipase
  - c. amylase
  - d. trypsin
359. What enzymes are present in pancreatic juice?
- a. trypsin, amylase, ptyalin
  - b. pepsin, trypsin, lipase
  - c. bile, lipase, ptyalin
  - d. lipase, amylase, trypsin
360. Where does the digestion (chemical food processing) begin?
- a. in buccal (oral) cavity
  - b. in esophagus
  - c. in stomach
  - d. in small intestine
361. Bile contains enzymes that help to break down:
- a. carbohydrates
  - b. fat
  - c. proteins
  - d. it does not contain any enzyme
362. Pancreas is a gland that produces:
- a. only hormones
  - b. only pancreatic juice with enzymes
  - c. hormones and digestive(pancreatic) juice
  - d. it is not a gland
363. The gastric juice of human contains:
- a. HCl, mucin, pepsin, lipase, chymosin
  - b. HCl, mucin, pepsin, amylase
  - c. only HCl, pepsin and chymosin
  - d. only HCl, lipase, chymosin and pepsin

364 . We can say about taste cells (receptors) in buccal (oral) cavity of human:

- a. they can distinguish 5 various taste qualities
- b. they can distinguish 4 various taste qualities
- c. all of them are evenly distributed in the buccal (oral) cavity
- d. they are stored in taste buds of tongue

365. Which of the following options does contain salivary glands that open into the buccal (oral) cavity?

- a. sublingual, submaxillar, zygomatic
- b. parotic, submaxillar, zygomatic
- c. submaxillar, sublingual, parotic
- d. submandibular, sublingual, parotic

366. What is the length of human large intestine?

- a. cca 1.5 m
- b. cca 2.5 m
- c. cca 0.5 m
- d. cca 3 m

367. What happens in large intestine?

- a. reabsorption of water and salts
- b. intestinal gas production by intestinal bacteria
- c. completion of nutrients absorption (carbohydrates, fats, proteins)
- d. completion of fat absorption

368. The end product of the digestion of saccharides is:

- a. glucose
- b. fructose
- c. galactose
- d. maltose

369. The end products of the digestion of fats are:

- a. fatty acids
- b. amino acids
- c. glycerol
- d. glucose

370. The end products of the digestion of protein are:

- a. mono peptides
- b. amino acids
- c. nucleotides
- d. fatty acids

371. Vitamins form the important part of nutrition because:

- a. they serve as antioxidants in an organism
- b. they prevent the breakdown of proteins
- c. they catalyse the biochemical reactions
- d. they support the resistance of organism

372. The lack of C vitamin causes:

- a. hypervitaminosis
- b. scurvy (scorbut)
- c. rachitis
- d. colour blindness

373. The excess of a vitamin in an organism is known as:

- a. avitaminosis
- b. hypovitaminosis
- c. multivitaminosis
- d. hypervitaminosis

374. What does the lack of vitamin in an organism cause?

- a. avitaminosis
- b. hypovitaminosis
- c. multivitaminosis
- d. hypervitammonosis

375. The important factor of blood coagulation is:

- a. B vitamin
- b. D vitamin
- c. E vitamin
- d. K vitamin

376. Vitamin D is:

- a. anticoagulant
- b. anti-rachitic vitamin
- c. anti-infective vitamin
- d. anti-scurvy vitamin

377. Components of the upper respiration tract are:

- a. paranasal sinuses, nasopharynx, pharynx
- b. nasal cavity and paranasal sinuses
- c. nasal cavity and nasopharynx
- d. nasal cavity and pharynx

378. Lower respiration tract consists of:

- a. pharynx, larynx and bronchial tubes
- b. nasopharynx, pharynx and bronchial tubes
- c. larynx, trachea and bronchial tubes
- d. trachea and bronchial tubes

379. Vocal folds (plica vocalis) are:

- a. stored in laryngeal cavity
- b. 2 vocal cords surrounding an opening between true vocal folds
- c. made of thin membranous epithelium
- d. longitudinal laryngeal cartilages

380. Visceral (pulmonary) pleura is:

- a. delicate serous membrane that covers the surface of the lung
- b. artery that carries the oxygenated blood to lungs
- c. vein that carries the oxygenated blood out of lungs
- d. a part of trachea that enters lungs

381. Alveoli are:

- a. branched capillaries in lungs
- b. vesicles in lungs
- c. places of gas interchanging in lungs
- d. olfactory receptors in nasal cavity

382. Pulmonary ventilation is:

- a. the interchange of respiratory gases between alveoli and blood
- b. the pulmonary examination with spirometer
- c. the air interchange between lungs and the environment
- d. the alternation of inhaling and exhaling

383. Vital capacity of lungs is:

- a. the total volume of lungs
- b. the respiratory surface of lungs
- c. the volume of the air interchanged in lungs in 1 minute
- d. maximum amount of air that can be expelled from the lungs after a maximum inhalation

384. External respiration is:

- a. the gas interchange between lungs and the environment
- b. the gas interchange between alveoli and the blood
- c. the gas diffusion through the alveolar-capillary membrane
- d. the alternation of inhale and exhale

385. Internal breathing is:

- a. passing of the oxygen from lungs to the blood
- b. the gas interchange between the blood and tissues
- c. the cell breathing process(es)
- d. the formation of oxy-hemoglobin

386. Respiratory centre of human body is:

- a. in diencephalon
- b. in medulla oblongata and pons
- c. on the floor of 4<sup>th</sup> brain ventricle
- d. in temporal brain lobe

387. What muscles are important for breathing of vertebrates?

- a. abdominal muscles
- b. intercostal muscles
- c. pectoral muscles
- d. diaphragm

388. The interchange of gases across the alveolar-capillary membrane is provided:
- a. by osmosis
  - b. by diffusion
  - c. by ionic interaction
  - d. along the concentration gradient
389. What components of blood do provide the CO<sub>2</sub> transport from tissues to the blood?
- a. red blood cells
  - b. white blood cells
  - c. blood plasma
  - d. lymph
390. During the gas interchange the carbon dioxide in alveoli:
- a. is bonded to heme
  - b. is bonded to globin
  - c. is bonded to plasma
  - d. diffuses from blood to the alveolar space
391. During the inflammatory disease the erythrocyte sedimentation rate:
- a. increases
  - b. decreases
  - c. does not change
  - d. is irregular
392. What is the percentage of water in blood plasma?
- a. 91 – 92%
  - b. 80 – 90 %
  - c. 70 – 80%
  - d. 93 – 97%
393. What are the functions of red blood cells?
- a. transfer of respiratory gases
  - b. nutrition transfer
  - c. pH maintaining
  - d. thermoregulation
394. What is oxygen in red blood cells bonded to?
- a. heme
  - b. agglutinin
  - c. iron
  - d. hemoglobin
395. What group of animals does have red blood cells without the nucleus?
- a. all mammals
  - b. all birds
  - c. none of vertebrates
  - d. only fish and amphibians do have nucleus in red blood cells

396. We can say about red blood cells of mammals:

- a. they do not have any organelles
- b. they are of discoid shape
- c. they do not have a nucleus
- d. they contain hemoglobin

397. What is red blood cell functional lifetime?

- a. 12 days
- b. 120 days
- c. 1200 days
- d. more than 1200 days

398. Red blood cells are produced:

- a. in bone marrow
- b. also in liver at the beginning of embryogenesis
- c. also in lymphatic nodes at the beginning of embryogenesis
- d. in spleen

399. Where are red blood cells degraded?

- a. in liver
- b. in spleen
- c. in lymphocytes
- d. in lymphatic nodes

400. Hematocrit is:

- a. the amount of red blood cells
- b. the amount of white blood cells
- c. red blood cells and white blood cells ratio
- d. percentage of red blood cells in a total blood volume

401. Thrombocytes (blood platelets) are produced:

- a. in liver
- b. in spleen
- c. in lymphatic nodes
- d. in bone marrow

402. What processes do help to stop bleeding?

- a. vasoconstriction
- b. hemocoagulation
- c. agglutination
- d. activation of trombocytes

403. What is vasoconstriction?

- a. it is the reaction of vessel after injury
- b. it is the process of red blood cell passing to tissues
- c. it is the reaction of agglutinogen and agglutinine
- d. it is the conversion of fibrinogen to fibrin

404. What is hemocoagulation?

- a. it is examination prior to blood transfusion
- b. it is sedimentation of red blood cells
- c. it is a formation of a blood clot
- d. it is a rection of blood vessel to injury

405. Which of the following organs participate in immunity?

- a. thymus
- b. spleen
- c. lymph nodes
- d. bone marrow

406. Thymus serves for:

- a. maturation of T-lymphocytes
- b. maturation of B-lymphocytes
- c. destruction of worn-out red blood cells
- d. production of hormones

407. We can say about thymus (sweetbread):

- a. it is the central organ of lymphatic system
- b. T-cells mature there to form imunocompetent cells
- c. in the adulthood the lymphatic tissue is substituted with adipose tissue
- d. in the adulthood it turns to spleen

408. The lymphatic system consists of:

- a. the system of open lymphatic vessels
- b. the thin capillaries opened into blood circulatory system
- c. lymphatic nodes
- d. liver

409. B-lymphocytes provide:

- a. the cell immunity
- b. the antibody immunity
- c. the cytotoxic reaction
- d. the allergic reaction

410. What cells do provide the antibody immunity?

- a. T-lymphocytes
- b. B-lymphocytes
- c. H-lymphocytes
- d. memory cells

411. Natural (inborn) immunity depends:

- a. just on T-lymphocytes
- b. just on B-lymphocytes
- c. on genetics
- d. on active immunity

412. Passive antibodies are:

- a. produced after the infection
- b. produced after vaccination
- c. delivered into the organism as ready-made or are obtained from mother
- d. are produced after conquering the infective disease

413. How do we know that there are some inflammatory processes in our body?

- a. the sedimentation is of higher rate
- b. the sedimentation is of lower rate
- c. there is an increase in number of white blood cells
- d. there is an increase in number of red blood cells

414. How many blood types do humans have?

- a. 2
- b. 3
- c. 4
- d. 5

415. Where is the antigen of blood type located?

- a. on the surface of white blood cells
- b. on the surface of red blood cells
- c. on the surface of blood platelets
- d. in blood plasma

416. If the agglutinogen is B and agglutinin anti A, what blood type are we speaking about?

- a. B
- b. A
- c. 0
- d. AB

417. If the agglutinogen is A and agglutinin anti B, what blood type are we speaking about?

- a. A
- b. B
- c. 0
- d. AB

418. If there is no agglutinogen on the surface of erythrocytes, and if there is agglutinogen

anti A and anti B in blood plasma, what blood type are we speaking about?

- a. B
- b. A
- c. 0
- d. AB

419. What blood types can patient with blood type of AB receive?

- a. AB
- b. A
- c. O
- d. B

420. During the cardiac cycle:

- a. the ventricular systole and atrial diastole alternate
- b. the atrial systole and ventricular diastole alternate
- c. the systole of right heart side and the diastole of left heart side alternate
- d. systole and diastole alternate

421. Veins are vessels that:

- a. carry blood towards the heart
- b. carry blood towards the right side of heart
- c. carry just deoxygenated blood
- d. have valves

422. Arteries are vessels that:

- a. carry blood towards left side of heart
- b. carry just oxygenated blood
- c. carry blood away from the heart
- d. have thicker walls than veins

423. Capillaries are vessels that:

- a. form the distributional system of vessels
- b. are formed only by one cell layer
- c. provide the nutrition interchange between the blood and tissues
- d. form the open system of vessels

424. Coronary arteries form:

- a. vessel network around alveoli
- b. their own cardiac cycle
- c. the blood cycle in kidneys
- d. capillary network anywhere in organism

425. The normal resting heart rate of healthy human is:

- a. 50 per minute
- b. 70 per minute
- c. 90 per minute
- d. 100 per minute

426. Minute volume of the heart is:

- a. amount of blood expelled per minute
- b. amount of blood which is oxygenated per minute
- c. 5 liters of blood in average
- d. 2 liters of blood in average

427. Blood pressure is measured by:

- a. spirometer
- b. sphygmomanometer
- c. at a person's upper arm (vein)
- d. at a person's upper arm (artery)

428. Aorta originates from:

- a. the left atrium
- b. the left ventricle
- c. the right ventricle
- d. the right atrium

429. Pulmonary circulation starts:

- a. in the right heart atrium
- b. in the right heart ventricle
- c. in the left heart ventricle
- d. in lungs

430. The primary urine production is connected with:

- a. renal corpuscle
- b. glomerular filtration
- c. Bowman's capsule
- d. canalicules of nephron

431. Definitive urine is produced by:

- a. renal tubules
- b. Bowman's capsule
- c. loop of Henle
- d. the process of reabsorption

432. Homeostasis is:

- a. stagnation in the organism development
- b. stable blood overflow through the heart
- c. the identical genome of mother and offspring
- d. the stability of an inner environment

433. What substances should not be present in the urine of healthy person?

- a. blood and pus
- b. proteins and carbohydrates
- c. a lot of proteins
- d. increased amount of carbohydrates

434. What is the difference between female and male urethra?

- a. female one is much shorter
- b. both are of the same length but part of female urethra is located in abdominal cavity
- c. female urethra provides only removing of urine from the body
- d. there is no difference between them

435. According to what principle does the excretory system of humans work?
- a. filtration of blood in kidneys
  - b. excretion of blood to kidneys
  - c. reabsorption of blood from kidneys
  - d. dialysis of blood in kidneys
436. Renal tubules enter:
- a. the bladder
  - b. the renal calyx
  - c. the renal pelvis
  - d. the efferent vein
437. What pigment does cause the skin coloration?
- a. keratin
  - b. melanin
  - c. tubulin
  - d. melatin (melatonin)
438. What receptors are there in human skin?
- a. warm and cold receptors, touch, pressure and pain receptors
  - b. warm receptors and tactile receptors
  - c. positional, balance, touch and pain receptors
  - d. thermoreceptors, radioreceptors and mechanoreceptors
439. When we speak about skin derivatives, what are we speaking about?
- a. just hair, nails and hairs
  - b. just hair and nails
  - c. hair, nails, hairs, cutaneous glands and lactic glands
  - d. just hair, nails, hairs and cutaneous glands
440. Myelin sheath:
- a. covers the axon
  - b. covers dendrites as well
  - c. covers only a body of neuron
  - d. covers neuroglia
441. Cerebrospinal fluid fills:
- a. the space between dura mater and arachnoid mater
  - b. the brain ventricles and central canal of spinal cord
  - c. 2 ventricles of fore brain
  - d. the central canal of spinal cord and the space between maters
442. What type of nerves does the vagus nerve belong to?
- a. cranial nerves
  - b. thoracic nerves
  - c. spinal nerves
  - d. autonomic nerves

443. How many cranial nerves does the human have?
- a. 7 pairs
  - b. 14
  - c. 20
  - d. 12 pairs
444. How many lumbar nerves does the human have?
- a. 10 pairs
  - b. 7 pairs
  - c. 5 pairs
  - d. 8 pairs
445. What part of central nervous system is the evolutionary youngest?
- a. diencephalon
  - b. midbrain
  - c. cerebral cortex
  - d. medulla oblongata
446. What brain part is considered to be the main control centre of inner organs?
- a. medulla oblongata
  - b. hypothalamus
  - c. cerebral cortex
  - d. cerebellum
447. What nerve centre is involved in the balance maintenance of human body?
- a. cerebral cortex
  - b. medulla oblongata
  - c. diencephalon
  - d. cerebellum
448. Where is the coordination centre located?
- a. in diencephalon
  - b. in thalamus
  - c. in cerebellum
  - d. in medulla oblongata
449. Cerebellum contributes to the control of:
- a. movement coordination
  - b. motoric reflexes
  - c. balance maintenance
  - d. face mimics
450. How many brain ventricles are there in the brain?
- a. 2
  - b. 4
  - c. 6
  - d. 3

451. Medulla oblongata contributes to the control of:

- a. movement coordination
- b. face mimics
- c. vital reflexes
- d. the heart and vessels activity

452. Pons (pons Varolii) serves as:

- a. the centre of movement coordination and balance maintenance
- b. the centre of digestion reflexes
- c. the interconnection between the spinal cord and diencephalon with other brain parts
- d. the centre of unconditioned reflexes

453. What are the brain and spinal cord covered with?

- a. dura mater
- b. arachnoid mater
- c. tela chorioidea
- d. pia mater

454. Hormones are substances from chemical point of view:

- a. lipids
- b. phospholipids
- c. proteins
- d. carbohydrates

455. The basic principle of hormonal regulation is:

- a. activation of biochemical processes
- b. inhibition of biochemical processes
- c. feedback principle
- d. maintenance of constant hormone levels

456. Where do endocrinal glands secrete their product?

- a. blood
- b. surrounding tissue
- c. lymph
- d. cerebrospinal fluid

457. Insulin is produced:

- a. in the islets of Langerhans in liver
- b. in the islets of Langerhans in pancreas
- c. in Malpighi cells of adrenals
- d. in Purkinje cells of cerebellum

458. What gland does produce the melatonin hormone?

- a. anterior pituitary (fore part of hypophysis)
- b. posterior pituitary (hind part of hypophysis)
- c. pancreas
- d. pineal gland (epiphysis)

459. What does the suprarenal gland produce?

- a. androgenic hormones
- b. cortisone
- c. adrenalin and noradrenalin
- d. cortisone and hydrocortisone

460. What gland is the thyrotrophic hormone produced by?

- a. thyroid gland
- b. pituitary gland (hypophysis)
- c. pineal gland (epiphysis)
- d. adrenal gland

461. What is the role of adrenalin?

- a. it helps to break the stress
- b. it increases the blood pressure
- c. it increases the blood sugar level
- d. it calms the nervous system down

462. Which hormone does cause the blood sugar level decrease?

- a. glucagon
- b. insulin
- c. adrenalin
- d. amygdalin

463. Which hormone does provide the glycogen cleavage in the liver and production of the glucose from amino acids?

- a. glucose
- b. insulin
- c. adrenalin
- d. glucagon

464. What hormone does regulate the blood sugar level?

- a. glucose
- b. insulin
- c. adrenalin
- d. cortisone

465. We can say about somatotrophic hormone:

- a. it is the growth hormone
- b. it is produced by anterior pituitary (adenohypophysis)
- c. it is species specific
- d. its insufficiency in pubescence causes the acromegaly

466. The excess of the growth hormone may cause:

- a. nanism
- b. cretinism
- c. gigantism
- d. acromegaly

467. What gonadotrophic hormones do we know?

- a. pineal gland (epiphysis) hormones
- b. reproductive gland hormones
- c. hormones, that stimulate the activity of reproductive glands
- d. adenohipophysis hormones

468. We can say about epiphysis (pineal gland):

- a. it occurs in diencephalon
- b. it occurs in cerebellum
- c. it produces the melatonin hormone
- d. it produces the somatotrophic hormone

469. The insufficiency of hormone of thyroid gland may cause:

- a. nanism
- b. cretinism
- c. goiter (struma)
- d. acromegaly

470. What type of receptors do thermoreceptors belong to?

- a. mechanoreceptors
- b. photoreceptors
- c. chemo receptors
- d. radioreceptors

471. We can say about proprioceptors:

- a. they are scattered throughout the corium (dermis)
- b. they inform about body position
- c. they occur in muscles and tendons
- d. they inform about pressure changes

472. Which of the following options is mechanoreceptor?

- a. static receptor (inner ear)
- b. organ of Corti
- c. proprioceptors
- d. ear bones

473. Organ of Corti occurs in:

- a. kidneys
- b. inner ear
- c. outer ear
- d. cochlear membranous labyrinth

474. What does the Eustachian tube provide?

- a. the perception of body position
- b. equalizing of the pressure between middle ear and nasopharynx
- c. the vibration of tympanic membrane (eardrum) during the sound perception
- d. the protection of vocal cords

475. Tympanic membrane (eardrum) is located between:

- a. external auditory canal and middle ear
- b. middle ear and cochlea
- c. Eustachian tube and middle ear
- d. cochlea and Eustachian tube

476. Ear bones transmit the sound in the direction:

- a. tympanic membrane (eardrum) - incus (anvil), malleus (hammer) - stapes (stirrup)
- b. tympanic membrane (eardrum) – malleus – incus – stapes
- c. malleus – incus – stapes – tympanic membrane (eardrum)
- d. tympanic membrane (eardrum) – stapes – malleus – incus

477. Inner ear consists of:

- a. Eustachian tube
- b. cochlea and semicircular canals
- c. three ear bones and cochlea
- d. cochlear membranous labyrinth

478. What retinal receptors are used for colour perception (vision)?

- a. rods
- b. cones
- c. chromatin
- d. chlorophyll

479. Where are receptors for the perception of body position located?

- a. in diencephalon
- b. in inner ear
- c. in middle ear
- d. in medulla oblongata

480. Human vision is:

- a. one-dimensional
- b. two-dimensional
- c. three-dimensional
- d. four-dimensional

481. When do women start to produce egg cells?

- a. during embryonic development
- b. in puberty
- c. after birth
- d. after achieving the ability to reproduce

482. The men's spermatogenesis starts:

- a. before birth
- b. after birth
- c. during puberty
- d. with sexual life

483. How long does a sperm cell live?

- a. 12 hours
- b. 24 hours
- c. 2 days
- d. 5 days

484. How many sperm cells are formed during the spermatogenesis from one germ cell?

- a. 2
- b. 3
- c. 4
- d. 5

485. Prostate gland is:

- a. paired endocrine organ
- b. unpaired exocrine organ
- c. unpaired organ made of connective tissue
- d. not a gland

486. How long does the women's pregnancy last?

- a. 260 days
- b. 270 days
- c. 280 days
- d. 290 days

487. What days of menstrual cycle do provide the highest probability of woman being fertilized?

- a. 12 – 16
- b. 17 – 21
- c. 22 – 26
- d. 27 – 31

488. When is baby's gender determined?

- a. in the first month of embryonic development
- b. in the third month of embryonic development
- c. by the birth
- d. in the moment of fertilization

489. How many egg cells do mature in ovaries during the woman's reproductive phase?

- a. 300
- b. 400
- c. 500
- d. 600

490. Corpus luteum is formed:

- a. from matured egg cell
- b. before egg cell maturation
- c. during ovulation
- d. from the cracked follicle

491. What hormone does corpus luteum produce?

- a. estrogene
- b. progesterone
- c. luteotrophic hormone
- d. testosterone

492. Where is the corpus luteum formed?

- a. on the kidney
- b. in testicle
- c. on ovary
- d. in the placenta

493. Corpus luteum produces the progesterone:

- a. during first 4 months of pregnancy
- b. during first 6 months of pregnancy
- c. during all pregnancy period
- d. it does not produce the progesterone

494. What phases is ovarian cycle divided to?

- a. ovogenesis, follicular and ovulation phase
- b. follicular, ovulation and luteal phase
- c. ovulation and menstrual phase
- d. progressive and regressive phase

495. What phases is uterine cycle divided to?

- a. menstrual, proliferative, secretory and ischemic phase
- b. ovulation, proliferative and secretory phase
- c. follicular, proliferative, secretory and ovulation phase
- d. secretory, menstrual, proliferative and ischemic phase\

496. How many days after fertilization does the implantation of the fertilized ovum in the endometrium (nidation) take place?

- a. during first 2 days after fertilization
- b. 2 – 4 days after fertilization
- c. 6 – 7 days after fertilization
- d. more than 10 days after fertilization

497. The nutrition, respiration and excretion during the intrauterine development of foetus are provided by:

- a. blastocyst
- b. placenta
- c. amnion
- d. umbilical cord

498. Placenta is attached to uterus by:

- a. chorionic villi
- b. umbilical cord
- c. placenta is the part of uterus
- d. the individual blood cycle

499. How long does the embryonic development last?

- a. from 1<sup>st</sup> – 5<sup>th</sup> week of development
- b. from 1<sup>st</sup> – 6<sup>th</sup> week of development
- c. from 1<sup>st</sup> – 8<sup>th</sup> week of development
- d. from 1<sup>st</sup> – 10<sup>th</sup> week of development

500. How long does the foetal development last?

- a. from 6<sup>th</sup> – 20<sup>th</sup> week of development
- b. from 9<sup>th</sup> – 35<sup>th</sup> week of development
- c. from 9<sup>th</sup> – 40<sup>th</sup> week of development
- d. from 10<sup>th</sup> – 40<sup>th</sup> week of development

# CHEMISTRY

Chemistry - correct answers are selected

1. Chemistry as a natural science
  - a. studies the properties of matter and its transformations
  - b. studies the chemical reactions
  - c. studies only the behavior of substances in chemical reactions
  - d. studies only the constitution of atoms and molecules
  
2. The chemical substance:
  - a. is one of the matter form
  - b. consists of particles with velocity lower than velocity of light (speed of light)
  - c. consists of particles bigger than  $10^{-7}$  m
  - d. can be the set of macroscopic bodies, e. g. planets, galaxies
  
3. The fundamental property of the matter is:
  - a. inertia
  - b. movement
  - c. colour
  - d. stiffness
  
4. Atom:
  - a. is the basic indivisible micro-unit of the substance
  - b. is the basic unit of the chemical substance, that consists of central nucleus and electron cloud
  - c. consists of protons, electrons and ions
  - d. is the smallest irreducible unit of chemical substance
  
5. Nuclides:
  - a. are substances consisting of atoms with the same proton (atom) number
  - b. are substances consisting of atoms with different proton (atom) number
  - c. are particles of the substance with the same proton (atom) number
  - d. are particles of the substance with the same numbers of protons and neutrons in the atom nucleus
  
6. Isotopes
  - a. are atoms with the same number of protons but different number of nucleons
  - b. are for example deuterium, tritium, and nitrogen
  - c. do not occur in nature
  - d. have the same number of protons and neutrons but different number of electrons
  
7. An element
  - a. is a particle of a chemical substance that consists of atoms with the same proton number
  - b. is a particle made of identical nuclides
  - c. is a substance made of atoms with the same proton number
  - d. is for example sodium, oxygen, and distilled water
  
8. A molecule
  - a. is a group of two or more atoms
  - b. is a group of two or more chemically bonded atoms
  - c. is a substance that consists of bonded atoms of several elements
  - d. is for example  $N_2$ ,  $F_2$ , or HCl
  
9. Chemically pure substance:
  - a. consists only of particles of the same type
  - b. can be a chemical element or a compound
  - c. is a substance, that remains unchanged (its properties) after purification
  - d. can only be a chemical element

10. The general electron configuration on the valence orbit
- Of  $p$  elements is  $ns^1 np^{1-6}$
  - Of  $p$  elements is  $ns^1-2(n-1)d^{1-10}$
  - Of  $p$  elements is  $ns^2 np^{1-6}$
  - for halogens is  $np^7$
11. The difference between mineral water and distilled water
- is in the concentration of dissolved ions
  - is in their ability to form hydrogen bonds between molecules
  - is none; they are the same
  - is in their electrical conductivity
12. Distilled water:
- when compared with drink water is a homogeneous solution
  - is a chemically pure substance
  - does not contain dissolved salts
  - is colloidal (heterogeneous) mixture
13. Mixture:
- can be homogeneous or heterogeneous (colloidal)
  - is homogeneous, if it consists of two or more substances with the same weight
  - is, for instance, filtered seawater
  - can be heterogeneous, if it consists of particles smaller than  $10^{-9}$  m
14. Solution:
- is a heterogeneous mixture consisting of two or more liquid substances
  - of proteins dispersed in water is colloid
  - always consists of the water and only one dissolved substance
  - of NaCl in the water is the chemical individual
15. Composition of solution can be expressed by:
- mass fraction
  - volume fraction
  - the osmotic pressure
  - degree of ionization
16. Mass fraction:
- is the fraction of the dissolved substance mass to the mass of the solvent
  - is the fraction of the dissolved substance mass to the mass of total mixture
  - is the fraction of the dissolved substance mass in 1000 g of water
  - can be expressed as a percentage
17. 25% solution of calcium sulphate consists of:
- 25 g of  $\text{CaSO}_4$  in 100 g of the solution
  - 25 g  $\text{Ca}_2\text{SO}_4$  in 100 g of the solution
  - 25 g of  $\text{CaSO}_4$  in 100 g of water
  - 25 g of  $\text{CaSO}_4$  and 75 g of water
18. What mixture must not be marked as suspension?
- of water and oil
  - of sand and oil
  - of gas and liquid
  - of crushed chalk and water

19. Emulsion is

- a. colloidal solution of egg white in water
- b. a mixture of two liquid immiscible substances
- c. a mixture of benzene and iodine
- d. for example a mixture of nonpolar liquid with water

20. Suspension is

- a. homogeneous mixture of liquid and solid substances
- b. heterogeneous mixture of liquid and solid substances
- c. for example unfiltered sea water
- d. mixture of two or more liquids with different molecular mass

21. Which of the following options is considered to be foam?

- a. a whipped cream
- b. a beaten egg-white
- c. a fog
- d. a yolk

22. The atomic mass unit

- a. is the mass of a hydrogen atom
- b. has a value of  $6.023 \cdot 10^{23}$
- c. has a value of  $1.66057 \cdot 10^{-27}$  kg
- d. is  $1/12$  of the mass of an  $^{12}\text{C}$  atom

23. Relative atomic weight:

- a. says, how many times is the atom of some element heavier than atomic mass (weight) constant
- b. is the total weight of all elementary particles in an atom
- c. allows us to calculate a weight of concrete atom
- d. is marked as  $A_r$  and it is a non-dimensional number

24. Relative molecular weight:

- a. is the sum of all relative atomic weights of all atoms in the molecule
- b. says, how many times is the molecule of the given substance heavier than atomic mass (weight) constant
- c. its unit is  $\text{g} \cdot \text{mol}^{-1}$
- d. its symbol is  $M_m$

25. Amount of substance (chemical amount):

- a. is the amount of the substance, containing the same number of particles as 12 g of nuclide  $^{12}\text{C}$
- b. is the amount of the substance, containing  $6.022 \cdot 10^{23}$  particles
- c. contains  $1.66 \cdot 10^{27}$  particles
- d. is  $6.022 \cdot 10^{23}$  g

26. Molar mass

- a. is the mass of 1 mole of a substance
- b. is expressed in  $\text{kg} \cdot \text{dm}^3$
- c. is expressed in  $\text{g} \cdot \text{mol}^{-1}$
- d. is expressed in  $\text{g} \cdot \text{mol}$

27. Calculate the molecular weight of NaOH:

- a.  $24.09 \cdot 10^{-23}$  g
- b.  $0.0415 \cdot 10^{-23}$  g
- c.  $6.64 \cdot 10^{-23}$  g
- d. 40 g

28. How many oxygen atoms are there in the molecule of potassium disulfide?
- 3
  - 5
  - 6
  - 4
29. According to the quantum-mechanical model of the atom:
- the electrons are moving around the atomic nucleus, with the spatial probability defined by an orbital
  - quantum numbers characterize energy and size of the orbitals
  - the electrons are orbiting around the atomic nucleus on circular trajectories
  - the electrons are orbiting around the atomic nucleus on circular trajectories, with the probability of occurrence defined by an orbital
30. Quantum numbers
- can be calculated from the Schrödinger wave functions
  - include  $n$ ,  $l$ ,  $m$ , and  $s$
  - characterize the energy of an electron
  - determine the number of electrons in a shell
31. The principal quantum number
- describes the energy and size of an orbital
  - has integer values from 0 to 7
  - is labeled with the letters K, L, M, N, O, P, Q
  - can theoretically take up integer values from 1 to  $\infty$
32. Select a correct statement(s):
- higher orbitals will be populated by electrons with lower energy
  - higher orbitals will be populated by electrons with lower electronegativity
  - higher orbitals will be populated by electrons with higher energy
  - higher orbitals will be populated by electrons with higher ionization energy
33. The Hund's rule
- gives the maximum number of electrons in a shell
  - is the rule of maximum multiplicity
  - allows to calculate the energy of an electron
  - describes bonding between atoms
34. Electrons in one orbital
- have the same energy
  - have the same value of the spin quantum number
  - have the same values  $n$ ,  $l$ ,  $m$ , but different values of  $s$
  - occur in the number dictated by the Hund's rule
35. Ionization energy
- increases with the increasing proton number within a group in the periodic system
  - decreases with the increasing proton number within a group in the periodic system
  - has maximal values for the elements from the I. A group
  - is largest for the transition metals
36. Electron affinity
- decreases in a downward direction in a group in the periodic system
  - is highest for fluorine
  - is highest for cesium
  - is the energy liberated when an atom in the gaseous phase takes up an electron
37. For the elements in the periodic system, it is true that:

- a. maximal positive oxidation state of a given element is equal to the number of the period in which this element occurs
- b. maximal positive oxidation state of a given element is equal to the number of the group in which this element occurs
- c. within a given period, electronegativity increases with the increasing proton number

38. Number of a group

- a. is identical with the principal quantum number of a given element
- b. is identical with the number of valence electrons of a given element
- c. is identical with the number of protons of a given element
- d. is identical with the maximal oxidation state of a given element

39. Number of a period

- a. is identical with the principal quantum number of a given number
- b. determines the highest electron shell found in a given element
- c. determines the number of proton in a given element
- d. determines the number of neutrons in a given element

40. The strongest reduction agents are

- a. the elements placed furthest left in a period of the periodic system
- b. the halogen elements
- c. the alkali metals
- d. the *d*-elements

41. Basic or base-forming oxides

- a. are only compounds of oxygen and the  $s^1$  a  $s^2$  elements
- b. are water-insoluble and react with acids and bases to produce salts
- c. react according to the equation  $O^{2-} + H_2O \rightarrow 2 OH^-$
- d. are oxides of metals with the oxidation state less than IV

42. For hydrides, it is true that

- a. the oxidation state of hydrogen is -1
- b. they are ternary compounds of hydrogen and more electronegative elements
- c. the non-polar hydrides do not react with water
- d. ionic hydrides are those which contain the  $s^1$  a  $s^2$  elements

43. A sodium cation is more stable than a sodium atom

- a. because the cation has the electron configuration of the inert gas Ne
- b. the statement is incorrect, the atom is more stable than the cation
- c. because the cation has the electron configuration of the heavier inert gas Ar
- d. because the cation is smaller

44. Alkali metals

- a. occur naturally only combined with other elements due to their reactivity
- b. stabilize their valence shell by accepting an electron to complete the *s* orbital
- c. are found in a human body only in the cationic form  $M^+$
- d. are hygroscopic and cause burns on skin and membranes

45. Halogens

- a. are, in contrast to their anions (halides), toxic for humans
- b. stabilize their valence shell by accepting one electrons to achieve the electron configuration of the nearest lighter inert gas
- c. stabilize their valence shell by accepting one electrons to achieve the electron configuration of the nearest heavier inert gas
- d. comprise the most electronegative elements

46. Halides

- a. are salts of simple inorganic acids HF, HCl, HI, and HBr
- b. are products of the reactions of a metal with HF, HCl, HI, or HBr
- c. cannot be produced by a direct reaction between a metal and a halogen
- d. may be produced, for example, by a reaction between  $\text{CaCO}_3$  and HCl

47. Upon sublimation of elemental iodine,

- a. intermolecular bonds are broken
- b. the structure of the atoms is degraded
- c. van der Waals interactions are broken
- d. covalent bonds are broken

48. Oxygen

- a. belongs among the most electronegative elements
- b. is more reactive in the form of isolated atoms than diatomic molecules
- c. forms cations  $\text{H}_3\text{O}^+$  upon reaction with water
- d. forms a single bond in a hydrogen peroxide molecule

49. Oxides

- a. include basic oxides, acidic oxides, and amphoteric oxides
- b. are divided into ionic, covalent, and molecular compounds according to their structure
- c. are produced exclusively by a direct reaction with oxygen
- d. are all water-soluble because they are polar compounds

50. A water molecule

- a. has polar covalent bonds and a bond angle of approximately  $104^\circ$
- b. may represent the central atom in coordination substances
- c. has its oxygen and hydrogen atoms bonded by hydrogen bonds, and therefore has water relatively high boiling temperature
- d. may form hydrates

51. Hydrogen sulphide:

- a. is smelly poisonous gas
- b. is a product of protein decomposition
- c. has only reducing effects
- d. is liquid, because there are hydrogen bonds between hydrogen sulphide molecules

52. The ability to form long chains

- a. is restricted to carbon
- b. is recognized also for silicon; silicon, however, forms shorter chains because of the weaker Si-Si bonds
- c. is recognized for all atoms with electronegativity higher than 2.0
- d. have all biogenic elements

53. Select the correct statement(s) about carbon:

- a. carbon atoms in graphite undergo the  $sp^2$  hybridization
- b. carbon atoms in diamond undergo the  $sp^3$  hybridization
- c. carbon atoms in graphite are bound together by four covalent, non-polar bonds
- d. carbon black and animal charcoal are amorphous carbon modification

54. Select the correct statement(s) about carbon dioxide:

- a. it is more soluble in a cold water than in a warm water
- b. it is not soluble in the water, because there is no molecular dipole moment in the molecule
- c. it is produced by a complete combustion of coal and hydrocarbons
- d. it has a reducing effect

55. For the hybrids it is true
- Ionic hybrids react with water producing acids
  - Ionic hybrids react with water producing hydroxide and hydrogen
  - Nonpolar hybrids are ampholyts
  - Polar covalent hybrids in water produce oxonium cation
56. The chemical compound of  $\text{COCl}_2$ :
- is used as narcotic in medicine
  - is product of combination of carbon dioxide with chlorine
  - is good solvent, especially of organic chemical compounds
  - is phosgene gas, very poisonous, used as chemical weapon
57. Carbon
- is a reducing agent
  - reacts with elements of lower electronegativity to form carbides
  - reacts with sulfur to form carbon disulfide,  $\text{CS}_2$
  - is not found in its elemental form in nature because of its reactivity
58. p-block elements:
- are elements, that have 1-8 electrons of p-orbital in their valence layer
  - are elements of all the A groups
  - are elements of III. A and IV. A group
  - are, for instance, hydrogen, nitrogen, sulphur, fluorine
59. What colour do vapours of volatile s-block elements give to the flame?
- Li - dark red
  - Na - green
  - potassium and rubidium - bluish violet
  - sodium - yellow
60. Sulphur dioxide:
- is a product of incomplete combusting of sulphur or fossil fuels
  - has only oxidizing effects
  - has oxidizing as well as reducing effects
  - if present in the air, causes acid rains
61. The nitrogen molecule is more stable than the nitrogen atom because:
- in the nitrogen molecule, there is a triple bond between nitrogen atoms
  - the nitrogen molecule have a greater total weight than nitrogen atom
  - the nitrogen molecule is non-polar
  - a formation of  $\text{N}_2$  is an exothermic reaction
62. We can say about ammonia:
- it is the end product of protein decomposition (in human body)
  - its reactions with acids produce ammonium salts
  - according to Brönstedt it is an acid
  - according to Brönstedt it is a base
63. Nitric acid:
- has strong oxidizing and reducing effects
  - reacts almost with all metals, besides gold and platinum
  - is product of the reaction of nitrous oxide and the water
  - gives salts - nitrates and nitrites

64.  $\text{H}_3\text{PO}_4$  acid:

- a. is a part of AMP and NAD molecules
- b. gives salts - only phosphates and hydrogen phosphates
- c. is component of membrane lipids
- d. causes a passivation of some metals

65. Phosphoric acid:

- a. is a product of dissolving of phosphorus pentoxide in the water
- b. gives salts - dihydrogen phosphates, hydrogen phosphates and phosphates
- c. belongs to the strongest acids
- d. has strong oxidizing effects already at room temperature

66. Select the incorrect statement(s) about silicon:

- a. comparing to carbon, silicon does not form stable chains, Si-Si bond is weaker than C-C bond
- b. it forms very stable compounds, where atoms -Si-O- alternate
- c. it is typical non-metal element
- d. it forms silicides with hydrogen, that are analogous to alkanes

67. We can say about III. A group elements:

- a. they stabilize their valence layer by taking three electrons in
- b. all of them are metals
- c. they form only covalent bonds
- d. all of them are metals, besides boron

68. We can say about metals:

- a. their atoms are arranged to form a crystal lattice, where they are bound together by metallic bond
- b. all of metals react with acids, producing salts and water
- c. physical properties of metals depend on number of valence electrons forming a metallic bond
- d. they have high ionisation energy

69. Metals can be obtained:

- a. by the reduction of their oxides
- b. only by the reduction with carbon
- c. by the reduction with carbon, aluminium, or by electrolysis
- d. by oxidation

70. The atom of carbon is:

- a. primary, if it is bound to only one carbon atom
- b. secondary, if it is bound to other three carbon atoms
- c. tertiary, if there are three different substituents bound to the carbon atom
- d. niladic, if it stands alone

71. Organic compounds:

- a. mostly contain non-polar covalent bonds in their molecules
- b. are not very water-soluble, but they dissolve in polar solvents
- c. are mostly soluble in non-polar solvents, e. g. benzene or other liquid hydrocarbons
- d. are flammable, during their combustion the carbon dioxide and water is produced

72. Isomerism:

- a. is a phenomenon where two molecules have the same molecular formula but differ in chemical and physical properties
- b. may only be spatial
- c. may only be optical
- d. may be spatial and constitutional (structural)

73. Structural (constitutional) isomerism:

- a. is determined by an arrangement and properties of atoms, groups of atoms, bond types and the way the atoms are bound
- b. belongs to the stereoisomerism
- c. may be cis-trans
- d. is given by the presence of a double bond between carbon atoms

74. Two organic compounds are isomers if:

- a. they have completely different physical and chemical properties
- b. they have exactly the same physical and chemical properties but different molecular formulas
- c. they have at least one different physical or chemical property but the same molecular formulas
- d. only if they have a different spatial arrangement

75. Alkanes:

- a. are hydrocarbons having only linear chains with simple non-polar covalent bonds
- b. may be linear, branched or cyclic
- c. have homologous formula  $C_nH_{2n+2}$
- d. with a lower carbon atom number are water-soluble

76. Carbon atom in alkanes:

- a. undergoes  $sp^3$ ,  $sp^2$ , or  $sp$  hybridization
- b. is always bound by single covalent bonds
- c. is replaced by a sulfur, nitrogen or oxygen atom in molecules
- d. is always tetravalent

77. We can say about alkanes:

- a. their physical properties depend on the number of carbon atoms in their molecules
- b. there are polar and non-polar covalent bonds in the alkane molecules
- c. alkanes having a carbon number C1 - C2 are water-soluble
- d. they are flammable

78. What are the characteristic reactions of alkanes?

- a. radical substitutions
- b. redox reactions
- c. radical additions
- d. eliminations

79. We can say about alkanes:

- a. they are very reactive, since the single bond between the carbon atoms is weaker than the multiple
- b. they are less reactive, non-polar hydrocarbons
- c. in nature they are only found in oil (petroleum) as their derivatives
- d. their characteristic reactions are radical substitutions

80. The addition is the reaction:

- a. in which there is no by-product
- b. in which an atom or group of atoms is bound to a multiple bond
- c. at which the bond multiplicity is decreased (reduced)
- d. that can not be nucleophilic

81. Addition reactions:

- a. are typical for all the hydrocarbons
- b. are characteristic for unsaturated hydrocarbons
- c. on the benzene ring run as electrophilic additions
- d. of alkenes and alkynes are electrophilic additions

82. Substitution reactions:

- a. are reactions, where atoms or group of atoms are bound to a multiple bond
- b. may be radical, electrophilic or nucleophilic
- c. are reactions that involve the replacement of an atom or group of atoms with another atom or group of atoms
- d. are only homolytic

83. Substitution reactions:

- a. are characteristic reactions of alkanes
- b. are characteristic reactions of aromatic hydrocarbons
- c. always run as addition-elimination mechanisms
- d. of alkanes are radical reactions

84. Which of following reactions can be considered to be the elimination reaction?

- a. formation of ethylene from ethanol
- b. formation of vinyl alcohol from acetylene
- c. reduction of propylene to propane
- d. formation of propylene from propane

85. We can say about alkanes:

- a. their complete combustion always gives the carbon dioxide and water
- b. their reaction with oxidizing agents produces alcohols (further oxidation produces carboxylic acids)
- c. they are less reactive
- d. their reaction with oxidizing agents produces esters

86. Alkenes:

- a. are less reactive than alkanes, because the C = C bond is stronger than a single bond
- b. are more reactive than alkanes
- c. are less reactive than alkynes, because the double bond is stronger than triple
- d. can form polymers

87. Select the correct statement(s):

- a. alkenes are found with alkanes in nature
- b. characteristic reaction of alkenes is radical substitution
- c. C = C bond in alkenes can be cleaved by homolytic and heterolytic agent according to the reaction conditions
- d. alkenes can form cis-trans isomers

88. How do we distinguish alkanes and alkenes?

- a. by the reaction with bromine water
- b. by the biuret reaction
- c. by Selivanov's reaction
- d. by the reaction with  $\text{KMnO}_4$  solution

89. We can say about alkynes:

- a. there are two carbon atoms ( $sp$  hybridized, in their molecules)
- b. they are less reactive than alkenes
- c. characteristic reactions of alkynes are electrophilic substitutions
- d. unlike alkenes they react with alcohols

90. Characteristic reactions of alkynes are:

- a. nucleophilic substitutions
- b. electrophilic substitutions
- c. hydrogenations
- d. for example – the additions of hydrogen halide

91. Alkynes can react with:

- a. alkaline hydroxides
- b. halogens in the presence of a catalyst (type  $\text{AlX}_3$ )
- c. water
- d. hydrogen halides

92. Select the correct statement(s):

- a. products of the halogenation of alkynes are derivatives of alkenes or alkanes
- b. products of the alkynes hydration are dihydroxyderivatives of alkanes
- c. the product of the ethene hydration is acetaldehyde
- d. the product of the alkyne hydrogenation is alkyne

93. We can say about alkynes:

- a. they can react with water
- b. they form acetylides
- c. they have mild alkaline properties
- d. hydrogen atoms in ethyne are slightly acidic

94. What type of reactions are characteristic for cycloalkanes?

- a. nucleophilic additions
- b. electrophilic additions
- c. radical substitutions
- d. eliminations

95. What can be ethene used for?

- a. production of vinyl chloride
- b. production of ethylene oxide
- c. production of allyl chloride
- d. production of acetaldehyde

96. We can say about ethene:

- a. it occurs in the oil (petroleum), coal and natural gas
- b. is a colorless gas with sweet smell
- c. is used for production of chlorinated solvents, plastics
- d. is used to accelerate the tropical fruit ripening

97. We can say about propene:

- a. it is used for production of plastics, acetone and cumene
- b. products of its reaction with halogens are alkenyl halides
- c. the product of its oxidation may be formic and acetic acid
- d. the product of its oxidation is cumene

98. Ethylene oxide:

- a. is produced by the dehydrogenation of ethylene
- b. its acidic or basic hydrolysis gives rise to ethylene glycol
- c. is stable cyclic ether
- d. is product of the ethylene oxidation

99. Benzene:

- a. is 1,3,5-cyclic hexatriene
- b. is the unsaturated hydrocarbon
- c. all of its the carbon atoms have  $sp$  hybridization, so the length of all the bonds in the aromatic ring is 0.139 nm
- d. is a regular hexagon, where all carbon atoms have  $sp^2$  hybridization

100. Characteristic reactions of benzene are:

- a. nucleophilic and radical reactions
- b. only electrophilic substitutions
- c. oxidations
- d. reductions

101. Characteristic reactions of arenes (aromatic hydrocarbons) are:

- a. radical substitutions
- b. radical additions
- c. electrophilic additions
- d. electrophilic substitutions

102. Benzyl chloride is:

- a. chlorine derivative of phenol
- b. functional derivative of benzoic acid
- c. monovalent group derived from benzoic acid
- d. chlorine derivative derived from toluene

103. Aniline:

- a. is the product of the nitrobenzene oxidation
- b. is as basic as a secondary amine
- c. is the product of the nitrobenzene reduction
- d. is the product of the aniline oxidation

104. The product of the styrene hydrogenation is:

- a. methylbenzene
- b. ethylbenzene
- c. ethylcyclohexane
- d. acetophenone

105. Derivatives of hydrocarbons:

- a. are hydrocarbons that have carbon atom replaced by another atom, such as chlorine, in a molecule
- b. are hydrocarbons that have only one hydrogen atom replaced by another atom or group of atoms, in the molecule
- c. are hydrocarbons that have one or more hydrogen atoms replaced by another atom or group of atoms, in the molecule
- d. may have, for example, nitrogen or oxygen atoms in the molecule

106. Halide derivatives:

- a. are colorless substances that are very water-soluble
- b. are very good solvents of non-polar substances, especially lipids
- c. with an increasing number of halogen atoms in the molecule decreases their flammability
- d. carbon tetrachloride is used to extinguish fire

107. Chloroform

- a. is a crystalline substance of sweet odour
- b. is decomposed by light to form phosgene
- c. its inhalation causes a temporary dysfunction of the cerebral cortex
- d. is used to extinguish fire

108. Freons:

- a. are derivatives of hydrocarbons, which molecule comprises at least two different halogens
- b. are derivatives of hydrocarbons, which molecule comprises at least two different halogens, of which one must be fluorine
- c. are dibromodifluoromethane and chlorofluoromethane, for instance
- d. are dichlorodibromomethane and dichlorodiiodomethane, for instance

109. We can say about C-halogen bond:

- a. its cleavage is hemolytic
- b. its cleavage is heterolytic
- c. may be cleaved by the action of electrophilic reagent
- d. is cleaved by the action of a nucleophilic agent

110. Cations of the alkali metals

- a. Are stable, because they have on the valence orbit configuration of the previous noble gas
- b. Are electrophil agents
- c. React with water as follows.  $2M^+ + 2H_2O = 2MOH + H_2$
- d. Do not participate in hydrolysis

111. Halogen derivatives can be prepared:

- a. by radical substitution from alkanes
- b. by electrophilic substitution from alkenes
- c. by electrophilic addition from unsaturated hydrocarbons
- d. by electrophilic substitution from aromatic hydrocarbons

112. The reaction of benzylchloride and sodium methoxide gives:

- a. ester
- b. propylbenzene
- c. methylbenzene
- d. ether

113. Diethylether can be prepared by the reaction of:

- a. sodium methoxide and 1-chloropropane
- b. potassium methoxide and chloroethane
- c.  $CH_3CH_2OK$  and  $C_2H_5Cl$
- d.  $C_2H_5OH$  and  $C_2H_5Cl$

114. The reaction of alkylhalide and alkoxide is:

- a. an electrophilic addition
- b. a nucleophilic addition
- c. a nucleophilic substitution
- d. an ether forming reaction

115. For alkynes it is true

- a. They can react with water
- b. They can generate acetylides
- c. They have got mildly basic character
- d. Hydrogen atoms in the ethyne are mildly acidic

116. Nitro compounds are hydrocarbon derivatives, that:

- a. have one of the hydrogen atoms substituted by  $-NO_2$  group
- b. are prepared by a nucleophilic substitution from halide derivatives and nitrites
- c. are products of the reaction of alcohol and nitrous acid
- d. have the nitroso group in their molecules

117. Nitro compounds are products of:

- a. electrophilic substitution occurring on the aromatic ring
- b. the reaction of glycerol and nitric acid, for instance
- c. the reduction of primary amines
- d. the reaction of primary amines with nitrous acid

118. We can say about aniline:

- a. it is product of the nitrobenzene oxidation
- b. it is product of the nitrobenzene reduction by hydrogen
- c. according to the positive mesomeric effect it is weak acidic
- d. it has basic properties

119. Nitro compounds are reactive, because

- a.  $-\text{NO}_2$  group is very good nucleophile
- b. they induce a negative inductive effect or a negative mesomeric effect
- c. nitroso group is a substituent, that accepts electrons willingly
- d.  $-\text{NO}_2$  group can be easily oxidized

120. We can say about nitro derivatives:

- a. nitrobenzene is reduced to aniline by hydrogen
- b. nitro derivatives that contains more nitro groups in their molecules, are explosive
- c. nitro derivatives are used for polymer production
- d. nitro derivatives are used for production of explosives, paints and drugs

121. Products of the reduction of nitroarenes are:

- a. amines with characteristic  $-\text{NH}_2$  group, in the acidic medium
- b. hydroxylamines with characteristic  $-\text{NH}-\text{OH}$  group, in neutral medium
- c. hydrazo compounds with characteristic  $-\text{NH}-\text{NH}-$ group, in alkaline medium
- d. always amines, medium does not matter

122. Nitro compounds are produced:

- a. from halogen derivatives of hydrocarbons and alkaline nitrites
- b. by aniline reduction
- c. by the direct reaction of hydrocarbons with nitric acid
- d. by the substitution of the carbon atom with nitrogen atom and following oxidation

123. Amine derivatives:

- a. according to the type of carbon atom, to which the  $-\text{NH}_2$  group is bound, we can divide amine derivatives into 3 groups – primary, secondary and tertiary
- b. according to the number of hydrogen atoms of ammonia, that are theoretically substitute with hydrocarbon residue, we can divide amine derivatives into 3 groups - primary, secondary and tertiary
- c. are of amphoteric character
- d. in the reaction with acids give ammonium salts

124. We cannot say about amines:

- a. amines with a small number of carbon atoms in their molecules are very water-soluble
- b. molecules of soluble amines form hydrogen bonds with water molecules
- c. all amines smell as ammonia
- d. all amines are white crystalline substances

125. Basic properties of amine derivatives:

- a. are caused by free electron pair of nitrogen atom
- b. depend on functional group type, bound to the nitrogen atom of ammonia group
- c. increase in the order phenylamine < methylamine < dimethylamine
- d. decrease in the order triethylamine > diethylamine > ethylamine

126. Which of the following amines is the most basic?

- a. methylamine
- b. dimethylamine
- c. trimethylamine, due to three inductive effects
- d. aniline

127. Which chemical compound does not have properties of amines?

- a. choline
- b. aniline
- c. urea
- d. guanidine

128. Which of the following chemical compound is the most basic?

- a. aniline
- b. ethandiamine
- c. hexandiamine
- d. dimethylamine

129. We can say about aniline:

- a. it is a weak acid
- b. it is a secondary amine
- c. it is a weak base
- d. the reaction with hydrochloric acid gives anilinium chloride

130. What type of reaction is the preparation of nitrobenzene from aniline?

- a. oxidation
- b. reduction
- c. diazotization
- d. coupling reaction

131. We can say about primary amines:

- a. they react with alkaline nitrites to produce azo compounds
- b. the product of the reaction of primary amines with sodium nitrite in the presence of hydrochloric acid (for example) is diazonium salt
- c. they react with nitrous acid to produce nitrosamines
- d. they are weaker bases than secondary amines

132. Secondary amines:

- a. are more basic than primary amines
- b. react with nitrous acid to form N-nitrosamines
- c. react with nitrites in acid medium to form the diazonium salts
- d. react only with concentrated mineral acids to form ammonium salts

133. Aniline is produced:

- a. by the nitrobenzene reduction
- b. by the reaction of bromobenzene with ammonia
- c. by the reaction of benzene with alkaline nitrites
- d. by the nitrobenzene oxidation

134. We can say about azo compounds:

- a. they are produced by the reaction of amines with phenols
- b. they are produced by the reaction of diazonium salts with aromatic phenols only
- c. they are used for the production of azo dyes
- d. they contain -N=N- group, so called chromophoric group

135. Select the correct statement(s):

- a. secondary amines act as electrophilic reagents
- b. amines act as nucleophilic reagents
- c. diazotization can be realized only at high temperatures
- d. primary amines react with halogen derivatives to produce secondary amines

136. Diazonium salts are produced:

- a. by the reaction of primary aromatic amines with nitrous acid
- b. by coupling
- c. by primary amines oxidation
- d. by the reaction of aromatic amines with alkaline nitrite in the presence of hydrochloric acid

137. Which of the following chemical compounds is not the naturally occurring amine?

- a. adrenaline
- b. niacin
- c. quinine
- d. nicotine

138. Naturally occurring amines:

- a. are components of living organisms
- b. are products of protein metabolism (in an organism)
- c. are, inter alia, adrenaline and acetylcholine
- d. are, inter alia, carotenes

139. The molecule of alkaloid includes:

- a. phosphor
- b. nitrogen
- c. sulphur
- d. halogen element

140. Methyl orange is:

- a. an indicator of redox reactions
- b. an indicator of acid-base reactions
- c. an azo dye
- d. a primary amine

141. Coupling is:

- a. for example, the reaction of diazonium salt with phenol
- b. for example, the reaction of diazonium salt with ammonia
- c. the reaction producing azo compounds that are used as dyes
- d. redox reaction

142. The product of the reaction of diazonium chloride with benzene is:

- a. azobenzene
- b. aniline black
- c. azo compound
- d. diazonium salt

143. The product of the dehydration of 2-pentanol is:

- a. 3-pentene
- b. pentane
- c. 2-pentanone
- d. alkene

144. Hydroxy derivatives:

- a. with the lowest number of carbon atoms (in their molecules) are colourless liquids with nice (pleasant) smell
- b. are very water-soluble
- c. are not soluble in water, because the dissociation does not occur
- d. their solubility increases with increasing number of carbon atoms in their molecules

145. We can say about hydroxy derivatives:

- a. with an increasing number of –OH groups in their molecules, their solubility in water increases
- b. phenols are white crystalline compounds, that change their colour into pink to brownish red due to the presence of the air
- c. hydrogen bonds are formed between molecules of hydroxy derivatives of hydrocarbons and water molecules
- d. all of them are non-polar substances

146. Hydroxy derivatives of hydrocarbons are divided into:

- a. monobasic, dibasic and polybasic, according to the number of –OH groups
- b. primary, secondary and tertiary, according to the number of –OH groups bound to the single carbon atom
- c. alcohols and phenols, according to carbon atom (where –OH group is bond. hybridization
- d. animal and plant groups, according to their origin

147. We cannot say about hydroxy derivatives:

- a. simple alcohols are very water-soluble, because between water molecules and alcohol molecules hydrogen bonds are formed
- b. comparing to corresponding hydrocarbons, hydroxy derivatives have higher boiling point due to hydrogen bonds between molecules of simple alcohol
- c. there are oxygen bonds between molecules of simple hydroxy derivatives
- d. complex alcohols are liquids of nice (pleasant) smell and narcotic effects

148. Alcohols comparing to basic hydrocarbons have higher boiling temperatures, because:

- a. besides carbon and hydrogen there is also an oxygen in their molecules
- b. between alcohol molecules and water molecules hydrogen bonds are formed
- c. between water molecules and –OH alcohol groups hydrogen bonds are formed
- d. they have higher molecular weight

149. Methanol:

- a. is used for the production of formaldehyde
- b. its preparation runs according to the equation:  $\text{CO} + \text{H}_2 \rightarrow \text{CH}_3\text{-OH}$  at elevated temperature and in the presence of a catalyst
- c. is toxic for human, lethal dose is 20-50 ml
- d. differs from ethanol primarily by odour

150. Ethanol:

- a. is industrially made by ethylene hydration
- b. is a product a fermentation of natural saccharides
- c. is colourless crystalline substance, very water-soluble
- d. is used as solvent

151. Glycerol:

- a. is the component of lipids
- b. is the raw material for the production of explosives
- c. is used as a drug in medicine
- d. is the component of lyddite

152. Ethanediol:

- a. is a liquid of sweet taste and is used as sweetener in food industry
- b. is used for antifreeze production
- c. is produced by acid or base hydrolysis of ethyleneoxide
- d. is toxic

153. Ethanediol is produced:

- a. by ethane oxidation
- b. by ethene oxidation
- c. by ethyleneoxide hydrolysis in the presence of an acid or a base
- d. by glycerol reduction

154. Hydroxy derivatives of hydrocarbons:

- a. are amphoteric
- b. their –OH bond is more polar than –OH bond in the water molecule
- c. that have the hydroxyl group bound to tertiary carbon atom, are the most acidic
- d. that have the hydroxyl group bound to primary carbon, are the most acidic

155. The presence of –OH group in molecule:

- a. underlies the amphoteric character of hydroxy derivatives of hydrocarbons
- b. underlies the solubility of simple alcohols in water
- c. causes the middle strong acidity of alcohols
- d. causes the basic character of alcohols

156. The acidity of alcohols decrease in the order:

- a. primary alcohol>phenol>secondary alcohol
- b. water>primary alcohol>secondary alcohol>tertiary alcohol
- c. phenol>primary alcohol
- d. water>phenol

157. We cannot say about alcohols and phenols:

- a. phenols are soluble in water
- b. with increasing number of –OH groups in phenol molecule, their solubility in water increases
- c. phenols and alcohols are colourless liquids of nice (pleasant) smell and narcotic effect
- d. phenol is white crystalline substance that turns pink when exposed to air

158. Phenol:

- a. is a white crystalline substance insoluble in water
- b. its hydrogen cation is cleaved more easily than from primary alcohol
- c. has a disinfecting effect
- d. is used in medicine to disinfect wounds

159. We can say about secondary alcohol:

- a. the product of its dehydration is alkene
- b. the product of its oxidation is carboxylic acid
- c. the product of its reduction is ketone
- d. the product of its oxidation is ketone

160. The product of an oxidation of propane-2-ol is:

- a. acetone
- b. glycerol
- c. aldehyde
- d. ketone

161. The product of an oxidation of ethanediol can be:

- a. glyoxal
- b. ethylene glycol
- c. glyoxylic acid
- d. oxalic acid

162. We can say about tertiary alcohol:

- a. it is a product of the reaction of secondary alcohol with water in acidic medium
- b. is more acidic than secondary alcohol
- c. is, for example, pyrogallol
- d. it cannot be oxidized to produce aldehyde

163. The product of the reaction of an acid with an alcohol is

- a. alkoxide
- b. alkyloxonium salt
- c. carboxylic acid
- d. the reaction of an acid with an alcohol cannot happen, because the alcohol has mild acidic character

164. According to Brönsted, hydroxy derivatives of hydrocarbons:

- a. are acids
- b. are bases
- c. are ampholytes
- d. cannot be acceptor nor donor of hydrogen cation

165. Glycerol is:

- a. tribasic alcohol
- b. tertiary alcohol
- c. optically active
- d. the component of cosmetic skin-care creams

166. We can say about glycerol:

- a. oxidation of its primary -OH group produces glyceraldehyde
- b. oxidation of its secondary -OH group may produce acetone
- c. oxidation of its secondary -OH group may produce dihydroxyacetone
- d. its oxidation to the second stage produces citric acid

167. We can say about glycerol:

- a. it is present in the human body as coenzyme
- b. it is produced by living organisms during the proteosynthesis
- c. it is produced by living organisms during the enzymatic hydrolysis of lipids
- d. it is the component of lipids and nucleic acids

168. Glycerine:

- a. is a water solution of glycerol, and is used in cosmetic industry
- b. moisturizes skin
- c. is the product of the reduction of glyceraldehyde
- d. is the alcohol solution of glycerol

169. The product of the reaction of alcohol with alkaline hydroxide is:

- a. alkoxide
- b. for example, sodium alcoholate
- c. phenoxide
- d. salt of the alcohol

170. The chemical compound  $\text{CH}_3\text{CH}_2\text{OK}$  is:

- a. potassium ethoxide
- b. potassium ethanoate
- c. potassium ethanolate
- d. produced by the reaction of sodium with ethanol

171. Potassium phenoxide:

- a. is produced by the reaction of benzoic acid with potassium
- b. is produced by the reaction of phenol with potassium hydroxide
- c. has ionic bond in its molecule
- d. is produced by the reaction of toluene with potassium

172. Hydroxy derivatives have amphoteric character because:

- a. there is  $\delta^-$  on the oxygen atom of  $-\text{OH}$  group, so it can accept hydrogen atom
- b. the O-H bond is polar and in the presence of stronger acid the  $\text{H}^+$  is cleaved off
- c. they cleave off the hydroxide anion in an acidic medium
- d. they cleave off the hydrogen in the presence of alkaline hydroxide

173. Alkyloxonium salts are produced:

- a. by the oxidation of an alcohol
- b. by the reaction of alcohol with fatty acid
- c. by the reaction of acid with phenol
- d. by the reduction of carboxylic acid

174. Phenols are more acidic than alcohols due to:

- a. the conjugation of free electron pair of oxygen atom and delocalized  $\pi$  electron cloud of the aromatic ring
- b. +M effect of  $-\text{OH}$  group
- c. -M effect of  $-\text{OH}$  group
- d. they are not more acidic, because the oxygen atom is strongly electronegative, so it pulls the aromatic ring electrons

175. How can we distinguish methanol and ethanol?

- a. they have different smell
- b. by the reaction with  $\text{KMnO}_4$
- c. by the reaction with  $\text{I}_2$  in the presence of alkaline hydroxide
- d. by the iodoform reaction

176. What can be considered to be a phenol?

- a. salicylic acid
- b. cresol
- c. *o*-xylene
- d. hydroquinone

177. The product of the oxidation of hydroquinone is:

- a. *p*-benzoquinone
- b. *m*-benzoquinone
- c. terephthalic acid
- d. aromatic diketone

178. *p*-benzoquinone is produced:

- a. by the reduction of pyrogallol
- b. by the dehydrogenation of hydroquinone
- c. by the dehydration of hydroquinone
- d. by the oxidation of hydroquinone

179. Select the correct statement(s):

- a. the reaction of phenols with  $\text{FeCl}_3$  produces coloured solutions
- b. phenol is very water-soluble
- c. phenol is the product of the oxidation of cumene
- d. the product of the total dehydrogenation of phenol is cyclohexane

180. Ethanol is liquid and ethane is gas due to:

- a. the lower molecular weight of ethane
- b. the stronger acidity of ethanol
- c. hydrogen bonds formed between ethanol molecules
- d. strong covalent bonds formed between ethane molecules

181. The product of the reaction of ethanol with  $\text{H}_2\text{SO}_4$  is:

- a. ethene, at higher temperature
- b. ester, in cool environment
- c.  $\text{CH}_3\text{-CH}_2\text{-O-SO}_3\text{H}$ , at low temperature
- d.  $\text{CH}_3\text{-CH}_2\text{-O-O-SO}_3\text{H}$ , at higher temperature

182. Disulfide bond:

- a. is produced by the oxidation of thiol
- b. is present also in protein molecules
- c. is produced by hydrogenation of ethanethiol
- d. plays role in protein tertiary structure

183. Dimethyl disulphide may be obtained:

- a. by the dehydration of methanethiol
- b. by the oxidation of methanethiol
- c. by the reduction of methanethiol
- d. from organic peroxides

184. Which of following options may be considered to be the metamer of dibutylether?

- a.  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_3$
- b.  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-O-CH}_3$
- c.  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-O-CH}_2\text{-CH}_2\text{-CH}_3$
- d.  $\text{CH}_3\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CH}_2\text{-CHO}$

185. According to the conditions of a reaction, the product of an oxidation of primary alcohol is:

- a. carboxylic acid
- b. ketone
- c. acetal
- d. aldehyde

186. The product of the reaction of hydroxy derivatives of hydrocarbons with:

- a. ketones are aldols
- b. hydrohalic acids are alkyloxonium salts
- c. mineral acids that contain oxygen are esters
- d. aldehydes are acetals

187. Vinyl alcohol:

- a. is produced by the addition of water to acetylene
- b. is produced by the addition of water to ethylene
- c. is produced by the dehydration of ethanol
- d. is unstable and is converted to the acetaldehyde

188. Acetone and vinyl alcohol are:

- a. optical isomers
- b. tautomers
- c. metamers
- d. not the isomers

189. We can say about carbonyl compounds:

- a. they have lower boiling point than hydroxy derivatives of hydrocarbons because there are no hydrogen bonds formed between their molecules
- b. simple aldehydes and ketones are very water-soluble because there are hydrogen bonds formed between their molecules and water molecules
- c. besides carbonyl group there cannot be any other substituent in their molecule
- d. all of them are products of an oxidation of primary hydroxy derivatives

190. We can say about aldehyde and ketone reactivity:

- a. it depends on functional groups bound to the carbonyl carbon atom
- b. it is almost identical, because aldehydes as well as ketones contain the same carbonyl group
- c. aldehydes are more reactive during the nucleophilic additions than ketones
- d. the reactivity of carbonyl compounds depends simply on  $\delta^+$  of carbonyl carbon

191. Formaldehyde is more reactive than acetaldehyde because:

- a. its carbonyl carbon atom is not affected by +I effect coming from hydrogen atoms
- b. its molecular weight is lower
- c. it is gas
- d. the intensity of  $\delta^+$  of carbonyl carbon decreases the +I effect of alkyl group

192. Characteristic reaction of aldehydes and ketones is:

- a. electrophilic addition
- b. nucleophilic addition
- c. elimination reaction
- d. electrophilic substitution

193. For the ethylene oxide it is true

- a. Is instable and hydrogenation produces the ethylene glycol
- b. Along acidic or basic hydrolysis is produced the ethane diol
- c. Belongs to ethers
- d. It is the ester of oxalic acid

194. Acetal reaction:

- a. is important in the industry
- b. is used for the protection of aldehyde group before oxidation
- c. runs only in the presence of the catalyst  $H^+$ , that eliminates the dissociation of aldehyde hydrogen cation
- d. runs only in the presence of the catalyst  $H^+$ , that supports the reactivity of carbonyl carbon

195. We can say about aldehydes and ketones:

- a. aldehydes and ketones are included in naturally occurred taste and smell substances
- b. benzaldehyde is a liquid with bitter almond smell and is present, for example, in bitter almond boneless
- c. acetone is produced by the glycolysis in an organism
- d. formaldehyde is used, for example, for laquer and plastic production

196. Formaldehyde:

- a. can be released from new furniture and can cause the headaches and dizziness
- b. is present in the cigarette smoke
- c. is toxic for human
- d. is white crystalline substance

197. Formalin:

- a. is a 3% solution of formaldehyde in water
- b. has antimicrobial properties
- c. is used for preservation of biological material
- d. is a 37% formaldehyde solution in water

198. The aldol condensation:

- a. is the reaction between molecules of carbonyl compounds in alkaline medium
- b. the reaction begins on such an aldehyde or ketone, that is more reactive and has at least one hydrogen atom bound to  $\alpha$ -carbon atom
- c. the reaction begins by the bonding of electrophile to the carbonyl carbon
- d. is, for example, the reaction between two molecules of formaldehyde

199. The reaction between formaldehyde and benzaldehyde:

- a. always begins on formaldehyde, because it is more reactive
- b. always begins on benzaldehyde, because it has higher electron density in an aromatic ring
- c. does not occur because formaldehyde does not have the  $\alpha$ -carbon atom, and benzaldehyde does not have hydrogen atom bonded to its  $\alpha$ -carbon atom
- d. does not occur because  $\alpha$ -carbon atom of formaldehyde and benzaldehyde does not have the hydrogen atom bonded to it

200. Chloroform

- a. Is crystalline substance with sweet odour
- b. Upon light it breaks down generating phosgene
- c. Following inhalation it causes temporary dampening of the brain cortex
- d. It is used for fire extinction

201. Acetone:

- a. is colourless gas with characteristic smell
- b. is used for laquers, paints (colours) and solvents production
- c. is produced by an organism during severe dehydration and during diabetic metabolic processes
- d. is a volatile, non-flammable substance

202. We cannot say about aldehydes and ketones:

- a. when compared with ketones, aldehydes are easily oxidized in the presence of weak oxidizer
- b. during the oxidation of aldehydes the carboxylic acids are produced
- c. C-C bond in ketones is stronger, therefore they are oxidized already by moderate warming up
- d. C-C bond in ketones is stronger, that is why they are hardly oxidized

203. How can we prove the presence of aldehydes?

- a. by Tollens reagent
- b. by Fehling's reagent
- c. by biuret reaction
- d. by bromine water

204. Carboxylic acids:

- a. occur as mono-, di-, tri-, . . . , polycarboxylic acids
- b. with a lower number of carbon atoms are of pungent odor
- c. are very water-soluble, because there is a polar group in their molecules
- d. with a lower number of carbon atoms have a higher boiling temperature than the corresponding hydrocarbons, because there are hydrogen bonds in their molecules

205. The acidity of carboxylic acids:

- a. only depends on the number of carboxyl groups in the molecule
- b. only depends on the hydrocarbon chain length
- c. depends on the concentration and on the number of -COOH groups in the molecule
- d. depends on the carbon chain length and on the carbon chain properties

206. We can say about properties of carboxyl group -COOH:

- a. the polarity of O-H bond determines the cleavage of H +
- b. in the anion  $\text{-COO}^-$  the negative charge is evenly distributed on both oxygens
- c. the length of all C-O bonds in the group -COOH is the same and it is 0.127 nm
- d. all three bonds on the carboxyl atoms are arranged in space and enclose an angle of  $107^\circ$

207. The strength of carboxylic acids is characterized by:

- a. pH
- b. concentration
- c. value of  $K_a$  and  $pK_a$
- d. ionization degree

208. Formic acid:

- a. is a colorless liquid with pungent odor and corrosive effect
- b. can be found in the bodies of ants, mosquitoes, bees and in nettle, but it has no practical application
- c. is used for metallization of metals, leather processing and in the synthesis of complex compounds
- d. is industrially produced from methanol and carbon monoxide

209. Oxalic acid:

- a. is a colorless liquid
- b. can be found in plants, such as sorrel, spinach
- c. is toxic to humans, because sodium oxalate is a component of kidney stones
- d. calcium oxalate is a component of kidney stones

210. Citric acid:

- a. is propantricarboxylic acid
- b. is tribasic hydroxy acid
- c. has antimicrobial properties and is useful in the food industry for food preservation (conservation)
- d. reduces ability of the blood to clott, because it binds calcium cations in the blood

211. Characteristic reactions of carboxylic acids are:

- a. neutralizations
- b. electrophilic substitutions
- c. nucleophilic substitutions
- d. dehydrogenations

212. We can say about the esterification:

- a. it is the reaction of carboxylic acid and alkaline hydroxide
- b. it is the reaction of alcohols and carboxylic acids in an acidic medium
- c. it runs as addition-elimination mechanism
- d. it is the reaction, in which the organic acid reacts with alcohol only

213. The neutralization is the reaction:

- a. of carboxylic acid and an organic base
- b. of carboxylic acid and hydroxide
- c. in which a salt of an acid and water are formed
- d. that gives rise to anhydride of an acid

214. We can say about esterification:

- a. the reaction mixture should be cooled, because the reaction is highly exothermic
- b. hydrogen cation as a catalyst increases the reactivity of the carboxyl carbon and decreases the acid dissociation
- c. acid can react only with a monohydric alcohol
- d. equilibrium of the reaction is shifted to the side of the reactants, so it is necessary to remove products

215. How is aspirin prepared?

- a. by the reaction of phthalic acid and ethanol
- b. by the reaction of benzoic acid and acetic acid
- c. by the reaction of salicylic acid and acetic acid
- d. by the reaction of salicylic acid anhydride and ethanoic acid

216. The acidity of polybasic carboxylic acids:

- a. depends only on the number of carboxyl groups in the molecule
- b. is characterized by  $pK_a$  value
- c. Adipic and glutaric acids are more acidic than acetic acid
- d. depends on the distance of carboxyl groups to each other in the carbon chain

217. We can say about carboxylic acids:

- a. the product of the propanedioic acid decarboxylation is acetic acid
- b. the product of the malic acid dehydration is maleic acid
- c. the product of the tartaric acid dehydration is acrylic acid
- d. the product of the linoleic acid hydration is oleic acid

218. Amino acids:

- a. are functional derivatives of carboxylic acids
- b. All of them have basic properties, because they contain a basic group-NH<sub>2</sub>
- c. contain functional groups that are able to accept and also to donate proton
- d. are ampholytes

219. Amino acids are ampholytes because:

- a. they do not dissociate in water
- b. they contain acidic as well as alkaline characteristic group in their molecules
- c. are capable to form the zwitterion
- d. they can be acidic, basic or neutral

220. Isoelectric point pI:

- a. is the  $pK_a$  value at which the amino acid does not move in an electric field
- b. is the equilibrium constant of the amino acid
- c. is the pH of the medium in which the amino acid (in solution) turns into amfion (zwitterion)
- d. is used for electrophoretic separation of amino acids

221. We can say about amino acids:

- a. nonessential amino acids need not to be included in the diet because the human body can form them from nitrogen, hydrogen and carbon
- b. amino acids having aromatic ring, heterocycle or branched chain in the molecule are essential
- c. nonessential amino acids can be prepared by transamination in human body
- d. essential amino acids can be prepared from non-essential amino acids by transamination in human body

222. We can say about hydroxy acids:

- a. they are products of the pyruvic acid oxidation
- b. lactic acid and salicylic acid are hydroxy acids
- c. hyaluronic acid is used in cosmetics as a component of anti-wrinkle creams
- d. they can be prepared by the glucose oxidation

223. Salicylic acid:

- a. is *o*-hydroxybenzoic acid
- b. is a functional derivative of benzoic acid
- c. in the reaction with acetic acid gives aspirin
- d. is a functional derivative of acetic acid

224. Pyrrole derivatives do not include:

- a. bilirubin
- b. chlorophyll
- c. myoglobin
- d. cholic acid

225. We can say about lactic acid:

- a. it is a colorless liquid
- b. there is the chiral carbon in its molecule
- c. it is produced by the cabbage fermentation (making sauerkraut)
- d. it may crystallize in muscles and causes "muscle soreness" during the excessive muscle activity

226.  $\text{CH}_3\text{-COO}^-$  is:

- a. acyl
- b. acetyl
- c. acetate
- d. pyruvate

227. Which of followings can be considered to be the carbonic acid derivative?

- a. guanidine
- b. phosgene
- c. urea
- d. uric acid

228. We can say about esters:

- a. they are very water-soluble because there are hydrogen bonds between their molecules
- b. esters include also lipids
- c. they are used in food industry as essences (e. g. rum, pear or pineapple)
- d. the ester of methacrylate acid and methanol is used to make Plexiglas

229. Which of following options is usually used as medicine (drug)?

- a. hydroxy derivative of salicylic acid, which has antipyretic effects
- b. salicylamide, which acts as an analgesic for central nervous system
- c. salicylic acid chloride, which acts as an analgesic
- d. aminosalicic acid that is used in the treatment of tuberculosis

230. p-aminobenzoic acid:

- a. is a component of the folic acid (vitamin B<sub>9</sub>)
- b. affects the regeneration of red blood cells
- c. is a growth factor of some micro-organisms
- d. supports the production and storage of lipids in adipose tissue

231. We can say about calcium oxalate:

- a. its chemical formula is (COOH)<sub>2</sub>Ca
- b. it is a component of kidney stones
- c. its chemical formula is CaOOC-COOC
- d. it supports blood clotting

232. We can not say about the oxalic acid:

- a. it is produced by the oxidation of ethanethiol
- b. its reduction gives 1,2-ethanediol
- c. it is a white crystalline solid
- d. it does not contain a chiral carbon

233. How can we distinguish formic acid and acetic acid:

- a. by the reaction with Fehling's reagent
- b. by the iodoform reaction
- c. by the reaction with an oxidizing agent, because only formic acid has reducing effects
- d. by the reaction with an oxidizing agent, because only acetic acid has reducing effects

234. Chemical formula R-CO-O-CO-R corresponds to:

- a. ester
- b. diketone
- c. anhydride
- d. organic peroxide

235. Which acid is formed by the addition of water to the acrylic acid?

- a. malic acid
- b. lactic acid
- c. pyruvic acid
- d. 2-hydroxypropanoic acid

236. How do we prepare the carboxylic acid?

- a. by the acidic hydrolysis of esters
- b. by the oxidation of the primary alcohol
- c. by the triglyceride hydrolysis in an acid medium
- d. by the oxidation of ketones

237. Heterocyclic compounds:

- a. are cyclic compounds having at least one hydrogen atom replaced by nitrogen, oxygen or sulfur atom in the molecule
- b. there is one or more carbon atoms replaced by other heteroatom, most often by nitrogen, oxygen or sulfur in the cycle
- c. are used as herbicides and insecticides
- d. may contain also silicon atoms in the molecule, because silicon is also able to form chains

238. Why are heterocycles important?

- a. they represent structural units (building blocks) of nucleic acids
- b. they occur in proteins, vitamins and alkaloids as an important component
- c. they form phospholipids
- d. they are used in pharmaceutical industry

239. We can say about heterocycles:

- a. heterocycles having the nitrogen atom in the molecule have such properties as amines have
- b. heterocycles having the oxygen atom (heteroatom) in the molecule are cyclic ethers
- c. all of them have basic properties
- d. they can not be divided into saturated and unsaturated heterocycles

240. Which of followings do belong to five-membered heterocycles with one heteroatom?

- a. thiazole
- b. pyrrole
- c. imidazole
- d. thiophene

241. Aromatic character of heterocyclic compounds:

- a. is formed only if the number of delocalized unpaired electrons corresponds to the Hückel rule  $(4n + 2)$
- b. is always formed by involving the lone electron pair of the heteroatom into the conjugation
- c. of furan, thiophene and pyrrole is the same
- d. decreases in the order thiophene > pyrrole > furan

242. Pyrrole:

- a. is a component of hemoglobin and chlorophyll
- b. is a component of bilirubin and bile acids
- c. is a component of bile pigments
- d. is a component of vitamin B<sub>12</sub>

243. We can say about bile pigments:

- a. they are products of the degradation of hemoglobin
- b. they play the most important role in the formation of bile acids
- c. there are four furan rings in their molecules
- d. they contain porphyrin structure

244. What molecule does contain two identical heteroatoms?

- a. thiophene
- b. imidazole
- c. thiazole
- d. oxirane

245. Pyrrole does not occur in the molecule of:

- a. indol
- b. purine
- c. tryptophan
- d. porphin

246. Pyrrole rings occur in the molecule of:

- a. hemoglobin
- b. B<sub>12</sub> vitamin
- c. bile acids
- d. uric acid

247. Pyrrolidine:

- a. is product of the hydrogenation of pyrrol
- b. is product of the oxidation of pyrrole
- c. has two heteroatoms in its molecule
- d. has aromatic character

248. We can say about pyrrole and pyridine:

- a. they have basic properties
- b. they differ in the formation of aromatic character
- c. they have different acid-base properties
- d. pyridine is a base

249. Select the correct statement(s):

- a. pyrazole and thiazole are used for the production of drugs that ease pain and reduce fever
- b. thiazole is used for the production of penicilline, sulphonamides and thiamine
- c. pyrazole is a component of H vitamin and histidine
- d. there is one oxygen atom and one nitrogen atom in the molecule of pyrazole

250. We can say about six-membered heterocyclic compounds with one heteroatom:

- a. there is a nitrogen atom (heteroatom) in their molecules
- b. they are for example, 2*H*-pyran, 4*H*-pyran and pyridine
- c. there are carbon atoms having  $sp$  and  $sp^2$  hybridization in their molecules
- d. all carbon atoms in their molecules have  $sp^2$  hybridization

251. We can say about pyridine:

- a. free electron pair of nitrogen is not involved in conjugation
- b. it has aromatic character due to the delocalized electron cloud formed by five unpaired electrons of carbon atoms and by one unpaired electron of nitrogen atom
- c. the electron density increases and the basic character occurs due to involving a free electron pair in the delocalization of  $\pi$ -electrons of nitrogen atom
- d. substitution reactions on pyridine run easier than on benzene

252. Pyridine:

- a. comparing to pyrrole, it has basic character
- b. the product of its dehydrogenation is piperidine
- c. is easily oxidized
- d. the product of its hydrogenation is piperidine

253. Nicotinic acid:

- a. is derivative of pyrimidine
- b. is converted into nicotinamid in the organism
- c. is a component of niacin
- d. can be produced from tryptophane, if there is enough B<sub>1</sub>, B<sub>2</sub> and B<sub>6</sub> vitamin in the organism

254. Pyridine:

- a. reacts with acids to produce salts
- b. the product of its reduction is piperidine
- c. is not a component of isoquinoline
- d. contains two oxygen atoms in its molecule

255. What chemical compound does have isomeric forms?

- a. pyrrole
- b. pyridine
- c. pyran
- d. porphin

256. Barbituric acid is produced:

- a. by the reaction of maleic acid with urea
- b. by the reaction of malonic acid with urea
- c. by the oxidation of pyrimidine
- d. by the reduction of thymine

257. Catalytic hydrogenation runs the most easily on:

- a. thiophene
- b. furan
- c. pyrrole
- d. pyrrolidine

258. By the hydrogenation:

- a. of furan the tetrahydrofuran is produced
- b. of thiophene the tetrathiophene is produced
- c. of pyrrole the piperidine is produced
- d. the aromatic character of heterocycle vanishes

259. We can say about heterocycles:

- a. pyridine is six-membered heterocycle, that contains two nitrogen atoms in its molecule
- b. uracil, cytosine and thymine are pyrimidine derivatives
- c. nicotinic acid and nicotinamide are pyrrole derivatives
- d. barbituric acid is produced by the condensation of malonic acid and urea

260. There are two condensed heterocycles in the molecule of:

- a. uric acid and caffeine
- b. adenine and guanidine
- c. adenine and guanine
- d. cytosine and barbituric acid

261. What chemical compound does form the tautomeric forms?

- a. thymine
- b. uracil
- c. pyridine
- d. uric acid

262. Uric acid:

- a. is produced by the degradation of pyrimidine compounds in human body
- b. is very water-soluble
- c. is a major component of urine
- d. is the end product of purine metabolism in human body

263. We can say about uric acid and urea:

- a. they differ in their solubility in water
- b. uric acid crystallizes in joints
- c. urea is the main component of urine
- d. both of them are produced by the decomposition of purine substances

264. Alkaloids:

- a. are naturally occurring substances with basic character
- b. all of them cause hallucinations
- c. are analeptics, that affect the central nervous system
- d. are, for example, caffeine, theine, theobromine

265. We can say about alkaloids use:

- a. codeine that belongs to the opium alkaloids is antitussive
- b. analeptics stimulate the central nervous system
- c. caffeine and morphine ease the pain
- d. nicotine eases the headache

266. What alkaloid does contain the tropane cycle in its molecule?

- a. caffeine
- b. atropine
- c. codeine
- d. cocaine

267. What alkaloid does not contain the quinoline or isoquinoline cycle?

- a. codeine
- b. morphine
- c. nicotine
- d. theobromine

268. What chemical compound is lysergic acid derived from?

- a. pyridine
- b. indole
- c. quinoline
- d. pyrrole

269. What chemical compound are caffeine and theobromine derived from?

- a. indole
- b. piperidine
- c. pyridine
- d. purine

270. What chemical compound is codeine derived from?

- a. indole
- b. purine
- c. isoquinoline
- d. tropane

271. The basic unit of the macromolecular substances:

- a. is the periodically repeated part of macromolecule that has the same chemical structure
- b. is the simplest group of atoms periodically repeated
- c. of polyethylene type is identical to the structural unit
- d. is the molecule that contains two double bonds or two reactive functional groups

272. The basic unit:

- a. of polypropylene is  $-\text{[CH}_2\text{-CH(CH}_3\text{)]}-$
- b. of polyterpene is  $-\text{[CH}_2\text{-C(CH}_3\text{)=CH-CH}_2\text{]}-$
- c. is always identical to the structural unit
- d. of polyethylene is  $-\text{[CH}_2\text{-CH}_2\text{]}-$

273. Structural unit:

- a. is a part of the macromolecule with the same chemical composition
- b. represents the simplest arrangement of building blocks (units) that are regularly repeated
- c. is for example - [A-B-C] -
- d. is only such molecule that have multiple bond

274. Polymerization:

- a. is the reaction of two identical monomers containing multiple bonds
- b. can be radical or ionic
- c. has addition-elimination mechanism
- d. is, for example, polystyrene production

275. Polycondensation:

- a. is stepwise reaction
- b. has addition-elimination mechanism
- c. is, for example, polyamides production
- d. is also the chain reaction

276. Synthetic rubber (caoutchouc) is produced:

- a. by the polymerization of but-1,3-diene or its derivatives
- b. by the polycondensation of isoprene and chloroprene
- c. by the copolymerization of butadiene and styrene
- d. by the copolymerization but-1,3-diene and adipic acid

277. Polyaddition:

- a. is the reaction of two monomers with reactive functional group, one of which is donor and one is the acceptor of the hydrogen cation
- b. is only radical reaction
- c. is the reaction of polystyrene production
- d. is the reaction of polyurethane production

278. Phenolic plastics, bakelites are made from:

- a. phenol and urea
- b. phenol and methanal
- c. formaldehyde and thiourea
- d. formaldehyde and phenol

279. Amino plastics are produced by:

- a. the polycondensation of diamide of carbonic acid and formaldehyde
- b. the polyaddition of uric acid and formaldehyde
- c. the polymerization of urea and methanal
- d. the copolymerization of formaldehyde and butadiene

280. Saccharides :

- a. consist only of carbon, hydrogen and oxygen atoms
- b. contain carbon, hydrogen, oxygen and nitrogen atoms in their molecules
- c. are hydroxy aldehydes or hydroxy ketones
- d. there are heteroatoms (sulphur or phosphor) in their molecules

281. We cannot say about saccharides:

- a. they are involved in animal and plant bodies
- b. they are energy storages in organisms
- c. they cannot be converted to other important substances in organisms
- d. they are a neutral component of nucleic acids

282. We can say about saccharides:

- a. they are produced by photosynthesis in nature
- b. they are considered to be heterocycles
- c. according to the number of monosaccharide units we can divide them into 3 groups – monosaccharides, oligosaccharides and polysaccharides
- d. all of oligosaccharides and polysaccharides have sweet taste

283. Monosaccharides:

- a. can have 3 to 9 carbon atoms in their molecules
- b. they are cleaved into simpler saccharides during the hydrolysis
- c. cannot be cleaved into simpler saccharides during the hydrolysis
- d. almost all of them have sweet taste

284. We can say about monosaccharides:

- a. they are white crystalline substances, very water-soluble
- b. they dissociate in water
- c. they are very soluble, because they form hydrogen bonds with water molecules
- d. they hydrolyze to  $\text{CO}_2$  and  $\text{H}_2\text{O}$  at higher temperature in the mineral acid medium

285. There is more than one chiral carbon atom in the molecule of:

- a. aldotriose
- b. ketotriose
- c. ketohexose
- d. galactose

286. D-glucose and L-glucose differ:

- a. in the number of chiral carbon atoms in their molecules
- b. only in the position of the hydroxyl group of the second carbon atom
- c. in the position of the hydroxyl group of the last chiral carbon atom
- d. in the way they rotate polarized light

287. We can say about aldose that has two  $-\text{OH}$  groups in its molecule:

- a. it gives glyceric acid by its own oxidation
- b. it gives glycerol by its own reduction
- c. it is called ethylene glycol
- d. it is called aldodiose

288. The product of the reduction of monosaccharide is:

- a. polybasic alcohol
- b. hemiacetal
- c. a substance that does not react with Schiff's reagent
- d. for example, ribitol, glucitol, galactitol

289. Cyclic forms of monosaccharides arise:

- a. from linear forms that are affected by ultraviolet radiation
- b. from intramolecular hemiacetal reactions
- c. from intramolecular esterification
- d. from the reaction of  $-\text{OH}$  groups of last chiral carbon atom and oxygen atom of aldehyde group

290. Anomers:

- a. are optical isomers
- b. are substances that rotate the plane of polarized light in the same angle to the left or right
- c. are substances that rotate the plane of polarized light in the same angle only to the left
- d. are substances, that do not rotate the plane of polarized light in the same angle to the left or right

291. The products of the oxidation of monosaccharide aldehyde group:

- a. are uronic acids in the presence of enzymes
- b. are aldaric acids in the presence of strong oxidizing agent (oxidizer)
- c. are aldonic acids
- d. are split carbon chains, but also simple aldehydes and ketones are formed

292. Glucaric acid:

- a. has two aldehyde groups in its molecule
- b. has one aldehyde and one carboxyl group in its molecule
- c. is dicarboxylic acid
- d. is produced by the reaction of glucose with strong oxidizing agent (oxidizer)

293. Aldaric acids:

- a. are formed by the action of very strong oxidizing agents on aldohexose
- b. are formed only by the action of reducing agents in the presence of enzymes
- c. are formed only by the action of oxidizing agents in the presence of enzymes
- d. are never formed from glucose

294. Gluconic acid:

- a. is the product of the reaction of glucose with strong oxidizing agent (oxidizer)
- b. is produced by mild oxidation of glucose
- c. is produced only in the presence of an enzyme
- d. does not have a chiral carbon atom

295. Cyclic form of monosaccharides is:

- a. glycoside
- b. ester
- c. acetal
- d. hemiacetal

296. Glucitol:

- a. is polyalcohol
- b. is produced by the reduction of glucose or fructose
- c. has only one carbonyl group in its molecule
- d. does not have reducing effects

297. Ribitol and galactitol:

- a. belong to the hydroxy derivatives
- b. are products of the monosaccharides oxidation in the presence of common oxidizing agents
- c. are products of the reduction of ribose and galactose
- d. their oxidation to the second stage forms corresponding acids

298. Manitol is produced:

- a. by the reduction of maltose
- b. by the hydrolysis of maltose
- c. by the reduction of mannose
- d. by the oxidation of mannose

299. Fructose gives a positive response to:

- a. the Molisch's reagent
- b. the nitrochrome
- c. the Fehling's reagent
- d. the bromine water

300. How can we prove the presence of a monosaccharide?

- a. by the iodine solution
- b. by the mixture of  $\text{HNO}_3$  and  $\text{K}_2\text{CrO}_4$
- c. by Fehling's or Tollens reagent
- d. by the iodoform reaction

301. How can we prove the presence of carbohydrates?

- a. by Selivan's reagent
- b. by the tincture of iodine
- c. by Molisch's reagent
- d. by the biuret reaction

302. How is the presence of reducing saccharide proven?

- a. by Fehling's reagent
- b. by Tollens' reagent
- c. by the nitro-chromic reaction
- d. by the reaction with iodine solution

303. How can we prove the presence of polysaccharides?

- a. by Fehling's reagent
- b. by Molisch's reagent
- c. by the reaction with iodine
- d. by the solution of  $\text{KMnO}_4$

304. What is the difference between ribose and deoxyribose?

- a. the carbonyl group type
- b. deoxyribose contains the keto-group and ribose is aldopentose
- c. the only difference between ribose and deoxyribose is that, there are only hydrogen atoms bound to the second carbon atom of deoxyribose
- d. the only difference between ribose and deoxyribose is the presence of the oxygen atom on the second carbon atom of monosaccharide

305. How can we prove the glucose in the urine?

- a. by Selivan's reagent
- b. by Molisch's reagent
- c. by Fehling's reagent
- d. by Tollens' reagent

306. How is the presence of cyclic form of glucose expressed?

- a. by a change of monosaccharide solubility
- b. it reacts with Fehling's reagent only at higher temperature
- c. by a change of optical activity
- d. it does not form O-glycosidic bonds

307. The product of the esterification of glucose is:

- a. only glucose-1-phosphate
- b. only glucose-6-phosphate
- c. according to reaction conditions glucose-1,6-biphosphate
- d. phosphoester bond on any of glucose carbon atoms

308. L-glucose:

- a. has  $-\text{OH}$  group bound to the last chiral carbon atom on the left side
- b. is physiologically important for human body
- c. it occurs in urine of diabetic patients
- d. is the left-handed (according to the polarized light) glucose form

309.  $\alpha$ -D-fructose-6-phosphate:

- a. is product of the esterification of fructose by phosphane
- b. is product of the reaction of the hydroxyl group of sixth fructose carbon atom with phosphoric acid
- c. cannot be produced, because there is hemiacetal hydroxyl bound to the sixth carbon atom
- d. is product of the esterification of primary  $-\text{OH}$  group of sixth carbon atom by  $\text{H}_3\text{PO}_4$

310. Select the correct statement(s):

- a. esterification can take place only on the hemiacetal hydroxyl of a monosaccharide
- b. in the molecule of glucose, hemiacetal hydroxyl or primary hydroxyl of sixth carbon atom can be esterified
- c. always just one –OH group can be esterified in molecule of monosaccharide
- d. glyceraldehydes cannot be esterified

311. Glycosides can be formed by the reaction:

- a. of any saccharide and alcohol
- b. of two monosaccharides
- c. of any primary hydroxyl and alcohol
- d. of hemiacetal hydroxyl and alcohol only

312. Glycosidic bond:

- a. is bond between hemiacetal hydroxyl and –OH group of alcohol
- b. can be formed between hemiacetal hydroxide of one monosaccharide and hemiacetal or primary hydroxyl of other monosaccharide
- c. is a covalent bond. When it is formed the water molecule is released.
- d. is coordination bond, so called donor-acceptor bond

313. Propyl- $\beta$ -D-glucopyranoside:

- a. is product of the reaction of propanol with  $\beta$ -D-glucopyranose
- b. is the product of the reaction of glucose's hemiacetal hydroxyl in  $\beta$  position and –OH group of propanol
- c. is product of the neutralization of propanol with gluconic acid
- d. propanol cannot react with glucose because there is no hemiacetal hydroxyl in its molecule

314. We can say about saccharose:

- a. it is so called beet sugar, and it is the sweetest sugar
- b. there is a glycosidic bond formed in its molecule, that is the product of glucose hemiacetal hydroxyl bonding to primary hydroxyl of the fructose's second carbon atom
- c. there is a glycoside bond formed in its molecule, that is the product of glucose's hemiacetal hydroxyl bonding to hemiacetal hydroxyl of the fructose's second carbon atom
- d. the formule of saccharose's glycosidic bond is  $\alpha 1 \rightarrow \beta 2$

315. Saccharose:

- a. contains  $\alpha$ -D-glucopyranose and  $\beta$ - L-fructofuranose
- b. is a non-reducing disaccharide, because there is no hemiacetal hydroxyl group in its molecules
- c. is reducing disaccharide, because glycosidic bond is formed between the hemiacetal hydroxyl of glucose and the hemiacetal hydroxyl of fructose
- d. even after its hydrolysis does not give a positive reaction with Fehling's reagent

316. We can say about ribose:

- a. it is part of the DNA
- b. it is ketopentose
- c. it is found in ATP
- d. it is an intermediate product of glycolysis

317. Milk sugar:

- a. is reducing saccharide
- b. is galactose
- c. is aldohexose
- d. is lactose

318. Which of these substances does have reducing properties?

- a. starch hydrolysate
- b. lactose
- c. maltose
- d. saccharose

319. Saccharose is non-reducing disaccharide because:

- a. glycosidic bond is formed between two hemiacetal hydroxyls
- b. there is no free hemiacetal hydroxyl in the molecule
- c. it does not react with Fehling's reagent
- d. it can not form esters

320. In the reaction of glucose with Fehling's reagent:

- a. the glucose is reduced
- b. the cupric cation (II) is reduced to cuprous cation (I)
- c. the red precipitate of  $\text{Cu}_2\text{O}$  is formed
- d. the copper oxidizes

321. What is the proof of the presence of glucose by Fehling's reagent based on?

- a. the oxidation of glucose
- b. the oxidation of cupric cation (II)
- c. the reduction of cupric cation (II)
- d. the reduction of hemiacetal hydroxyl

322. Dihydroxyacetone:

- a. is the simplest ketotriose
- b. oxidizes to glyceric acid
- c. is formed by glycolysis in the human body
- d. is formed by the oxidation of the secondary carbon atom of glycerol

323. Maltose:

- a. is glucopyranosyl-glucopyranose
- b. consists of two molecules of  $\alpha$ -D-glucopyranose bound by  $\alpha$  (1  $\rightarrow$  4) bond
- c. is a malt sugar and is formed by starch degradation by maltase
- d. consists of galactopyranose and glucopyranose

324. We can say about lactose:

- a. there is free hemiacetal hydroxyl in its molecule, therefore it is reducing disaccharide
- b. it can be of plant or animal origin
- c. the glycosidic bond  $\beta$  (1  $\rightarrow$  4) causes its non-reducing effects
- d. it is split into glucose and galactose by the action of maltase

325. Starch:

- a. is a polysaccharide of plant origin
- b. consists of amylose and amylopectin
- c. contains glycoside bonds  $\alpha$  (1  $\rightarrow$  4) and  $\beta$  (1  $\rightarrow$  4)
- d. contains glycoside bonds  $\alpha$  (1  $\rightarrow$  4) and  $\alpha$  (1  $\rightarrow$  6)

326. Starch, cellulose and glycogen:

- a. differ only in their occurrence in nature
- b. do not differ in the composition
- c. differ in the type of glycosidic bond
- d. contain glycosidic bonds  $\alpha$  (1  $\rightarrow$  4) and  $\alpha$  (1  $\rightarrow$  6)

327. Starch and glycogen:

- a. are composed of  $\alpha$ -D-glucopyranose
- b. contain  $\alpha$  glycoside bonds  $\alpha$  (1  $\rightarrow$  4) and  $\alpha$  (1  $\rightarrow$  6)
- c. differ in occurrence in nature, starch is the plant polysaccharide and glycogen is of animal origin
- d. differ in water solubility

328. Glycogen:

- a. is a polysaccharide of animal origin
- b. is the storage material and is stored in adipose tissues
- c. we distinguish muscle glycogen and liver glycogen
- d. is also found in some plants

329. Maltose:

- a. arises from starch by the action of amylase in human body
- b. is formed by the oxidation of mannitol
- c. is split into carbon dioxide, water and energy by maltase
- d. is a reducing disaccharide

330. Cellulose unlike starch:

- a. is water-soluble
- b. contains glycoside bonds  $\beta$  (1  $\rightarrow$  4)
- c. is indigestible to humans, because amylase cleaves only  $\alpha$ -glycoside bond
- d. may be proven by iodine solution

331. We can say about polysaccharides:

- a. glycogen unlike starch and cellulose may be proven by Fehling's reagent
- b. polysaccharides do not have a reducing effects
- c. polysaccharides do not have a sweet taste
- d. glycogen is the storage material in animal body (including human)

332. How is glucose formed from disaccharides and polysaccharides?

- a. by the reduction
- b. by the hydrolysis in an acidic medium
- c. by the hydrolysis in the presence of amylase or disaccharidases
- d. it takes place in the stomach by the action of trypsin

333. We can say about cellulose:

- a. it is a linear polysaccharide
- b. it forms a colloidal solution in water
- c. it is the most common polysaccharide in the biosphere
- d. it is used in the manufacture of viscose rayon

334. Lipids are:

- a. esters of long chained fatty acids and tertiary alcohol
- b. esters of long chained fatty acids and tribasic alcohol
- c. ethers of long chained fatty acids
- d. ethers of long chained fatty acids and monohydric alcohols with long carbon chain

335. Lipids are divided into several groups:

- a. according to the origin (plant, animal and synthetic)
- b. according to the alcohol content (acylglycerols and waxes)
- c. according to the composition (simple and phospholipids)
- d. according to the carboxylic acid content (fats and oils)

336. What is the importance of lipids in the human body?

- a. they form cell membranes
- b. they create an environment in which non-polar substances, such as vitamins or drugs are dissolved
- c. they are involved in protein synthesis
- d. they are broken down by the action of lipase to form glycerol and fatty acids

337. Which of following options can be considered to be the unsaturated fatty acid?

- a. linoleic acid
- b. arachic acid
- c. butyric acid
- d. oleic acid

338. Which of following options can be considered to be the non-essential fatty acids?

- a. arachidonic acid
- b. aspartic acid
- c. stearic acid
- d. palmitic acid

339. Which of following options does contain two or more double bonds in the molecule?

- a. oleic acid
- b. linolenic acid
- c. arachidonic acid
- d. elaidic acid

340. We can say about lipids:

- a. they are hydrophobic
- b. they are insoluble in cold water but they dissolve in warm water
- c. they need not to be supplied in the diet, because our body can produce them
- d. they are insoluble in water, they can form only colloids or micelles

341. Which of following options can be considered to be fat?

- a. all lipids of plant origin
- b. lipids that contain a higher percentage of saturated fatty acids
- c. all acylglycerols
- d. mostly lipids of animal origin

342. Melting point of lipids:

- a. depends only on the esterified carboxylic acid chain length
- b. depends only on the number of unsaturated bonds in the molecule
- c. depends on the esterified carboxylic acid chain length and the number of unsaturated bonds in the molecule
- d. decreases with shortening of carboxylic acid chain, and with increasing number of unsaturated bonds in the molecule of lipid

343. Fatty acids are:

- a. water-insoluble carboxylic acids
- b. carboxylic acids, that contain at least sixteen carbon atoms and that have an even number of carbon atoms
- c. unbranched-chain carboxylic acids with minimum of sixteen carbon atoms in their molecules
- d. aromatic carboxylic acids

344. Essential fatty acids:

- a. are produced by the saturated carboxylic acids dehydrogenation in the human body, so their intake in the diet is not needed
- b. have the aromatic ring or heterocycle in the molecules
- c. have two or more double bonds in their molecules
- d. are important in the metabolism of saturated fatty acids and cholesterol

345. The product of the complete hydrogenation of  $C_{19}H_{31}COOH$  is:

- a. oleic acid
- b. linoleic acid
- c. arachidic acid
- d. saturated hydrocarbon

346. The product of the reaction of  $C_{17}H_{29}COOH + 2H_2$  is:

- a. linoleic acid
- b. oleic acid
- c. octadecenoic acid
- d. saturated fatty acid

347. We can say about lipids:

- a. unsaturated fatty acids in lipid molecules are cis-isomers
- b. trans-isomers of fatty acids are produced by partial hardening of lipids
- c. cool-pressed oils are not suitable for fritting
- d. lipids with high percentage of unsaturated fatty acids are thermostable

348. Acylglycerols:

- a. can be divided into mono-, di- and tri-acylglycerols
- b. are simple, if there are only saturated fatty acids in their molecules
- c. are combined, if the glycerol is esterified by various fatty acids
- d. contain long-chain monobasic alcohol and long-chain carboxylic acid in the molecule

349. What chemical bond is present in the molecule of simple lipid?

- a. carboxy phosphoesteric bond
- b. esteric bond
- c. O-glycosidic bond
- d. peptide bond

350. Triacylglycerol:

- a. contains three carboxylic acids bound to the tertiary alcohol, in its molecules
- b. contains carboxylic acids bound together by carboxyl-ester bonds
- c. contains also the phosphoesteric bond
- d. is 1,2,3-propanetriol

351. 2-stearylglycerol:

- a. is monoglycerol
- b. is composed of stearyl alcohol and glycerol
- c. is glycerol with two esterified carbon atoms
- d. is glycerol with esterified  $-OH$  group on the secondary carbon atom

352. We can say about acylglycerol molecule:

- a. there is one, two or three esterified hydroxyl groups there
- b. there are only primary hydroxyl groups esterified
- c. it may contain identical or different long-chained acyls of carboxylic acids
- d. it contains only saturated acyls of fatty acid

353. Simple lipids:

- a. there is glycerol and the alcohol component in their molecules
- b. there is only alcohol component together with long-chained carboxylic acids in their molecules
- c. are, for example, waxes
- d. are, for example, acylcholesterols

354. Ester bonds in triacylglycerol molecule can be cleaved:

- a. by the hydrolysis in the presence of the lipase
- b. by the oxidation in the presence of oxidoreductase
- c. by the acidic or basic hydrolysis
- d. by the decarboxylation

355. Lipids rancidification (ageing):

- a. is the oxidation of unsaturated bonds
- b. is the oxidation of double bonds of carbon chains resulting in the formation of simple aldehydes and ketones
- c. due to the yellow colour and the smell of new-formed aldehydes and ketones is called yellowing
- d. is not caused by microorganisms in warm and moist environment

356. Lipids hardening:

- a. is catalytic dehydrogenation of oils
- b. is radical substitution
- c. is stepwise reaction
- d. destroys the biological value of plant oils

357. Hydrolysis of lipids:

- a. in an acidic medium gives rise to glycerol and fatty acid
- b. in an alkaline medium gives rise to the salt of glycerol and fatty acids
- c. in the presence of NaOH gives rise to carboxylic acid sodium salt and alcohol
- d. in an alkaline medium is called saponification

358. Which of following options can be considered to be the soap?

- a. sodium palmitate
- b. potassium acetate
- c. all sodium salts of carboxylic acids
- d.  $\text{CH}_3-(\text{CH}_2)_{16}-\text{COONa}$

359. Effects of soap as a laundry detergent are based:

- a. on the presence of polar and non-polar molecule parts of sodium palmitate
- b. on the orientation of hydrophobic part of the molecule of the soap into the non-polar impurity structure
- c. on the presence of hydrophilic part of the soap molecule in the surface of micelle
- d. on the fact that the soap precipitates in the hard water

360. Complete hydrogenation of linoleic acid forms:

- a. palmitic acid
- b. oleic acid
- c. stearic acid
- d. linolenic acid

361. The product of the hydrolysis of phospholipids is not:

- a. the phosphoric acid
- b. choline
- c. glycerol
- d. cetyl alcohol

362. What reaction is the soap product of?

- a. triglyceride hydrolysis in the presence of NaCl
- b. lipid hydrolysis in the presence of NaOH
- c. lipid hydrolysis in the presence of alkaline hydroxide and hydrolase (enzyme)
- d. the reaction of palmitic acid and sodium hydroxide

363. Waxes:

- a. are simple lipids
- b. are esters of monohydric alcohols and long chained fatty acids
- c. may contain cetyl alcohol or ceryl alcohol
- d. are only of animal origin

364. Complex lipids:

- a. contain only glycerol esterified with phosphoric acid in the molecule
- b. are for example, phospholipids, that may include choline, serine or ethanolamine in their molecules
- c. are for example, esters of glycerol and phosphoric acid
- d. contain for example galactose or the protein part in their molecules

365. We can say about complex lipids:

- a. they may have emulsifying properties
- b. they are also called membrane lipids
- c. they are only phospholipids
- d. they are for example, cholesterol esters

366. We can say about phospholipids:

- a. they contain glycerol esterified by phosphoric acid and choline
- b. they contain only ethanolamine or serine besides glycerol and fatty acids
- c. they consist of glycerol, fatty acids, phosphoric acid
- d. they also contain ethanolamine, choline and serine besides glycerol and the fatty acid

367. Polar part of the phospholipid contains:

- a.  $H_3PO_4$
- b. ethanolamine, choline and serine
- c. glycerol
- d. anion of an acid

368. The non-polar part of the phospholipid contains:

- a. the carbon chain of fatty acid
- b. choline
- c. ethanediol
- d. ethanolamine

369. Lipoproteins:

- a. also contain the protein residue besides the alcohol and acid component in the molecule
- b. in the blood plasma are for example involved in cholesterol transport
- c. are found in cell membranes
- d. also contain glucose or galactose in the molecule

370. Which of following chemical compounds is/are important for the lipids metabolism?

- a. lipase, which breaks down the lipid ester bonds
- b. gastric acid and pepsin, which breaks down fatty acids
- c. bile acids that emulsify lipids
- d.  $\beta$ -carotene and vitamin C

371. We can say about cholesterol:

- a. it is derived from cyclopentanoperhydrophenanthrene
- b. it can be esterified by long chained carboxylic acid
- c. it does not occur in the human body, it must be supplied in the diet
- d. it occurs as free and esterified (form) in the organism

372. We can say about cholesterol:

- a. it is a part of cell membranes
- b. it is the precursor for insulin and glucagon
- c. it gives rise to bile acids
- d. it is a component of bilirubin and biliverdine

373. The cholesterol in the body is precursor for:

- a. sex hormones
- b. bile pigments
- c. vitamin A
- d. bile acids

374. Bile acids:

- a. have shorter side chain than cholesterol
- b. act as enzyme in digestion of fats
- c. are products of cholesterol reduction
- d. contain porphin in the molecule

375. Phytol belongs to:

- a. monoterpenes
- b. diterpenes
- c. triterpenes
- d. tetraterpenes

376. What can be esterified in the molecule of cholesterol:

- a. only hemiacetal hydroxyl
- b. carboxyl group (by glycerol)
- c. hydroxyl group on the third carbon atom
- d. nothing can be esterified there

377. We can say about steroids:

- a. they are of animal or plant origin
- b. they include hormones, bile acids, alkaloids and some vitamins
- c. there is a heterocycle in their molecules
- d. they have an aromatic character

378. We can say about sterols:

- a. phytosterol is of animal origin
- b. ergosterol is found in the yeast
- c. by UV irradiation of ergosterol vitamin B<sub>12</sub> is produced
- d. by UV irradiation of ergosterol ergocalciferol, vitamin D<sub>2</sub> is produced

379. Bile acids:

- a. are formed in the liver from cholesterol
- b. are products of the degradation of hemoglobin
- c. are found in adipose tissues, where they are formed from cholesterol
- d. are formed in the small intestine

380. What processes are bile acids important for?

- a. the formation of steroid hormones
- b. the absorption of lipids
- c. the emulsification and breakdown of triglycerides
- d. the hydrolysis of water-insoluble proteins

381. Steroid hormones do not include:

- a. adrenal cortical hormones
- b. corticosteroids
- c. insulin and glucagon
- d. cholecalciferol

382. Proteins in the human body:

- a. have structural and kinetic function, for example – hemoglobin
- b. may be replaced by lipids or polysaccharides
- c. have transport, regulatory and defensive function
- d. are an important component of nucleic acids, as neutral components of nucleotides

383. Proteins consist of:

- a.  $\alpha$ -amino acids only
- b. neutral amino acids such as serine, valine or glycine only
- c. the neutral saccharide component, alkaline base and amino acid
- d. amino acids having only one-COOH group and one-NH<sub>2</sub> group in the molecule

384. Essential amino acids:

- a. must be supplied in the diet
- b. have one-NH<sub>2</sub> group bound to the  $\beta$ -carbon
- c. are for example phenylalanine, tryptophan and lysine
- d. contain the heterocycle in their molecules

385. Sulfur atom is contained in the molecule of:

- a. asparagine
- b. methionine
- c. serine
- d. cysteine

386. Heterocycle is contained in the molecule of:

- a. tyrosine
- b. tryptophan
- c. histidine
- d. asparagine

387. The functional group of  $\begin{array}{c} \text{NH} \\ || \\ \text{---C---NH}_2 \end{array}$  is contained in the molecule of:

- a. asparagine
- b. aspartate
- c. arginine
- d. glutamine

389. We can say about amino acids:

- a. they occur only in the food of animal origin
- b. the organism can produce glucose from them
- c. non-essential amino acids are formed by transamination of oxo acids in the human body
- d. the product of metabolism of amino acids is urea in human body

390. We can say about tyrosine:

- a. it is a hormone that is produced in the thyroid gland
- b. its precursor may be phenylalanine in the organism
- c. it is a hydroxy derivative of phenylalanine
- d. it does not have an aromatic character

391. Which of following amino acids can be considered to be acidic?

- a. glutaric acid
- b. glutamic acid
- c. aspartic acid
- d. ascorbic acid

392. Which of amino acids can be considered to be basic?

- a. lysine, proline, histidine
- b. histamine, arginine, asparagine
- c. lysine, histidine, arginine
- d. amino acid that has more  $-NH_2$  groups than  $-COOH$  groups in the molecule

393. Characteristic reactions of amino acids are:

- a. dehydrating reactions
- b. decarboxylation and deamination reactions
- c. redox reactions
- d. condensation and transamination reactions

394. Transamination:

- a. is the reaction of preparing non-essential amino acids
- b. takes place in the presence of a derivative of vitamin  $B_6$  - transaminase (coenzyme)
- c. is the reduction of oxogroup
- d. is for example, the production of tryptophan

395. Chemical bond of  $-CO-NH-$ :

- a. is the coordinate bond
- b. it is formed by the condensation of two amino acids, releasing water molecule
- c. it is formed by the reaction between  $-COOH$  groups of two amino acids
- d. it is formed by the reaction of the  $-NH_2$  group of one amino acid and  $-COOH$  group of the other

396. We can say about peptide bond:

- a. it is a stable covalent bond
- b. it has a planar structure
- c. we can prove it by biuret reaction
- d. it is very stable and only cleaves during denaturation

397. pI value:

- a. is dissociation constant of the amino acid
- b. for essential acids is equal to 7
- c. is pH of the medium in which the amino acid is in the form of amfion (zwitterion)
- d. is characteristic for each amino acid

398. The primary structure of proteins:

- a. indicates the biological value of protein and determines higher protein structures (secondary, tertiary...)
- b. is determined by amino acid sequence in the polynucleotide chain
- c. is stabilized by hydrogen bonds between molecules of amino acids
- d. is determined by the order of amino acids bound by peptide bonds

399. We can say about the geometric arrangement of polypeptides:

- a. it is called  $\alpha$ -helix, if hydrogen bonds are formed between the oxygen and hydrogen atoms of peptide bonds in a single polypeptide chain
- b. amino acid residues are bound together by van der Waals forces within the helix
- c. amino acid residues do not participate in the secondary structure, they are arranged into the outer space of helix
- d. it is not destroyed by denaturation

400. We can say about proteins:

- a. they are found in the blood of a healthy person
- b. they are found in the urine of healthy person
- c. important ones are only of plant origin
- d. they play an important role as a part of nucleic acids

401. Histones:

- a. are found in the nucleus of cells
- b. are proteins that contain a higher ratio of basic amino acids
- c. in the cell nucleus are bound to nucleic acids
- d. have acidic character

402. Proteins are irreversibly denatured by:

- a. strong acids
- b. the solutions of alkali metals
- c. the solution of lead chloride
- d. transferases

403. Enzyme:

- a. is the biocatalyst, which not only accelerates the reaction but also regulates it
- b. likewise catalyst decreases the activation energy value
- c. unlike catalyst must be supplied during the reaction
- d. operates only by its active center, not by the entire surface as the catalyst

404. Effect-specificity of enzyme:

- a. is related to the structure of the enzyme allosteric center
- b. is related to coenzyme
- c. is the ability of the enzyme to catalyze only one thermodynamically possible transformation of the substrate
- d. does not allow cleavage of cellulose by  $\alpha$ -amylase

405. The enzyme can be activated by:

- a. the separation (removing) of low-molecular part of a peptide chain
- b. the chemical modification such as phosphorylation
- c. bonding of the allosteric activator to its active site
- d. the activity of metallic cations such as  $Zn^{2+}$ ,  $Mg^{2+}$  or  $Cd^{2+}$

406. The enzyme can be activated by:

- a. the presence of cations such as  $Zn^{2+}$  or  $Mg^{2+}$
- b. the separation of the part of enzyme active site
- c. the bonding of allosteric activator to the enzyme active site
- d. the formation of covalent bonds between an activator and an enzyme

407. Pepsin:

- a. is synthesized as pepsinogen in an organism
- b. its molecular weight decreases with its activation
- c. is the catalyst of aminoacides cleavage
- d. is the catalyst of polysaccharides cleavage

408. Inhibition:

- a. can be reversible and irreversible
- b. is competitive or uncompetitive
- c. cannot be allosteric
- d. can be only irreversible

409. Competitive inhibition:

- a. can be reversible
- b. can be removed by increasing of substrate concentration
- c. can be removed by increasing of enzyme concentration
- d. can be removed by increasing of enzyme or substrate concentration

410. Non-competitive inhibition:

- a. can be reversible and irreversible
- b. can be eliminated by increasing the substrate concentration
- c. is for example the poisoning by some toxins
- d. is the type of inhibition, in which the inhibitor may be bound to any reactive functional group of the enzyme, what interferes with the affinity of enzyme to the substrate

411. We can say about uncompetitive inhibition:

- a. inhibitor is irreversibly bound to the enzyme active site
- b. uncompetitive inhibition by heavy metals causes enzyme denaturation
- c. inhibitor is bound only to the enzyme allosteric site
- d. uncompetitive inhibition by light metals causes enzyme denaturation

412. We can say about enzyme inhibition:

- a. the heavy metal poisoning results in the enzyme denaturation, but the metal cation is not bound to the enzyme active site
- b. allosteric inhibitor is always bound to the enzyme active site
- c. competitive inhibition always causes the denaturation of an enzyme
- d. during the biochemical processes the product of one chemical reaction can act as inhibitor of the previous one

413. Hydrolases cleave:

- a. non-covalent bonds in proteins
- b. O-glycosidic bonds
- c. ester bonds in lipids
- d. hydrogen bonds

414. We can say about hydrolase:

- a. it catalyses the dehydration of substrate
- b. a coenzyme of hydrolase is FAD
- c. it is, for example, lipase
- d. it catalyses the cleaving of peptide bonds

415. Oxidoreductases:

- a. they catalyse only the oxidation of substrate
- b. they catalyse all redox processes
- c. coenzymes of oxidoreductases are FAD, NAD<sup>+</sup>
- d. they enable the oxidation of aldehyde to ethanol

416. Isomerases catalyse:

- a. isomers rearrangement
- b. for example, the conversion of glucose-6-phosphate to fructose-6-phosphate
- c. for example, the conversion of ribose to deoxyribose
- d. besides isomerization reactions they also catalyse polymerization reactions

417. We can say about lyases and ligases:

- a. ligases catalyse a synthesis of two substrates in the presence of ATP
- b. ligases catalyse a synthesis of two substrates in the presence of  $\text{NAD}^+$
- c. lyases catalyse the nonhydrolytic cleavage of C-C bond
- d. lyases and ligases can catalyse the same reaction types

418. Which of followings can be contained in the molecule of oxidoreductase coenzymes NAD, FAD?

- a. pyridine
- b. purine
- c. vitamin PP
- d. ribose

419. Nucleic acids:

- a. are responsible for the organization and reproduction of living matter
- b. are polypeptides
- c. contain acidic, neutral and basic component
- d. are biomacromolecule substances having peptides as their structural units

420. DNA and RNA differ in:

- a. pentose; DNA contains deoxyribose and RNA contains ribose
- b. their presence in cell nucleus
- c. the content of nitrogenous bases
- d. a structure

421. We can say about nucleotide structure:

- a. it consists of  $\text{H}_3\text{PO}_4$  bound to the purine or pyrimidine base by phosphoester bond
- b. nitrogenous base is bound to the first carbon atom of pentose by N-glycosidic bond
- c. pentose is bound to the phosphoric acid by phosphoester bond
- d. acidic and basic part of nucleotide are bound together by an amide bond

422. Polynucleotide is produced:

- a. by the condensation of nucleotides
- b. by the polymerization of nucleotides
- c. by the formation of 3', 5'-diphosphoester bonds between nucleotides
- d. by the polyaddition of nucleosides

423. Nucleotides and nucleosides:

- a. differ in the acidic component of their molecule
- b. free nucleotides and nucleosides occur in cells and they have various functions
- c. free nucleotides and nucleosides do not occur in cells
- d. there are alkaline bases bound together by high-energy bond in their molecules, therefore they are energy transferring agents

424. We can say about high-energy chemical compounds:

- a. they are, for example, ATP, GTP, NAD, FAD
- b. there is high-energy bond formed in their molecules
- c. during the hydrolytic cleavage of phosphoester bond, the energy is released
- d. they are, for example, ATP, GTP, acetyl-CoA

425. We can say about the structure of DNA:

- a. primary structure of DNA depends on the sequence of nucleotides (bound together by 3', 5'-diphosphoester bonds)
- b. the disorder of the sequence of nucleotides causes genetic mutation
- c. DNA contains 4 nucleotide types – adenine, cytosine, guanine and uracil
- d. DNA has primary, secondary, tertiary and quadruple structure like proteins do

426. Complementarity of nitrogenous bases:

- a. depends on the presence of characteristic groups, where hydrogen bonds are formed between bases
- b. means that there are always two hydrogen bonds formed between adenine and cytosine
- c. means that there are three hydrogen bonds formed between guanine and cytosine
- d. means that we can replace a part of DNA sequence with part of mRNA sequence

427. Select the incorrect statement(s):

- a. the complementarity of bases takes part in protein biosynthesis between codon and anticodon
- b. codon and anticodon are bound together by an ester bond
- c. in the DNA macromolecule, the ratio A:U is always 1:1
- d. transcription is based on the complementarity of bases

428. The secondary structure of DNA:

- a. is double  $\alpha$ -helix
- b. is based on the complementarity of purine and pyridine bases
- c. is the result of hydrogen bonds formed between purine and pyrimidine bases of two polynucleotide chains
- d. is the result of hydrogen bonds, van der Waals forces and disulfide bonds

429. We cannot find in DNA:

- a. guanidine
- b. guanine
- c. ribose
- d. phosphoric acid

430. Transfer RNA (tRNA):

- a. its secondary structure reminds "clover leaf"
- b. during the transcription it transfers nucleotides to the place where messenger RNA is formed
- c. at the longer end there is always the triplet CCA, where the amino acid is bound to
- d. it contains the codon

431. Select the correct statement(s) about RNA:

- a. there are codons in the molecules of mRNA
- b. secondary structure of rRNA is double  $\alpha$ -helix, and in the places where the complementarity of bases is broken, oval projections also known as "loops" are formed
- c. rRNA is formed in ribosomes
- d. rRNA molecule has double-strand form

432. tRNA

- a. always has the adenylyl nucleotide at the one end
- b. during the translation there is the ester bond formed between the amino acid and the third ribose carbon atom of adenylyl nucleotide
- c. during the translation there is ester bond formed between the amino acid and the anticodone
- d. during the translation there is the ester bond formed between the amino acid and the first ribose carbon atom of the adenylyl nucleotide

433. Transcription:

- a. is the translation of the nucleotide sequence into amino acid sequence
- b. is the transcription of the genetic information from DNA to mRNA based on complementarity of bases
- c. takes place in cell nucleus
- d. takes place in cell cytoplasm

434. Ammino acyl-tRNA:

- a. is formed by bonding of activated amino acid (at the longer end. to the last adenine nucleotide (on its third ribose carbon atom) by ester bond
- b. is formed by bonding of the activated amino acid to anticodon
- c. is formed by bonding of the amino acid to the phosphoric acid of the last nucleotide by amide bond
- d. is formed by bonding the amino acid to the last nucleotide adenine of longer end by N-glycosidic bond

435. Translation:

- a. is the translation of nucleotide sequence to the sequence of amino acids of the peptide chain
- b. always starts on the "start codon" AUG
- c. at the beginning of the translation, the methionyl-tRNA occurs on the ribosomal peptidyl transferase centre
- d. there is the peptide bond formed between the initiator and "start codone"

436. "Start codon":

- a. is the initiation codon
- b. defines the bonding of methionyl-tRNA to the mRNA
- c. defines the bonding of methionyl-tRNA to the rRNA
- d. is not complementary to any codon, it just provides the energy to the translation process

437. Genetical information of human cell is coded in:

- c. histones
- d. chromosomes
- e. tRNA
- f. DNA

438. Osmosis:

- a. procures the water transfer in organism
- b. does not depend on dissociation of substances dissolved
- c. depends on the concentration of substances dissolved
- d. it is not important for an organism

439. Osmosis:

- a. is process in which the solvent particles pass trough semi-permeable membrane
- b. is the opposite of diffusion
- c. requires the presence of semi-permeable membrane
- d. is process in which the specific particle dissolved in the solution pass through semi-permeable membrane

440. Which solution does have the highest osmotic efficiency by the identical concentration of chemical amount?

- a. solution of ammonium sulphate
- b. solution of potassium chloride
- c. solution of glucose
- d. solution of saccharose

441. Physiological solution:

- a. is isotonic comparing to inner environment of cell
- b. isolated hepatic cells do not change their volume in it
- c. is isotonic comparing to saccharose solution with concentration 0.15 mol/l
- d. is glucose solution

442. We can say about water solution of saccharose ( $c=0.2 \text{ mol/l}$ ); NaCl ( $c=0.1 \text{ mol/l}$ );  $\text{AlCl}_3$  ( $c=0.2 \text{ mol/l}$ ) at identical temperature:

- a. saccharose and aluminium chloride solutions are isotonic
- b. saccharose solution is hypertonic comparing to sodium chloride solution
- c. saccharose solution is isotonic comparing to sodium chloride solution
- d. aluminium chloride solution is hypertonic comparing to saccharose solution

443. Metabolic pathway:

- a. is a set of biochemical reactions, that follow each other
- b. is a set of reactions, where the product of one reaction is the starting material for the following reaction
- c. is for example the neutralization reaction or complex reactions
- d. is always reversible

444. Which of following reactions can be considered to be amphibolic reaction?

- a. formation of glycogen
- b. glycolysis
- c.  $\beta$ -oxidation of fatty acids
- d. transamination

445. The mechanism of redox processes is based on transfer of:

- a. hydrogen atoms to the  $\text{NAD}^+$  pyridine ring
- b. hydrogen atoms to the  $\text{NAD}^+$  purine ring
- c. hydrogen atoms to the  $\text{NAD}^+$  pyrimidine ring
- d. hydrogen atoms to the NADP

446. Endergonic reactions:

- a. take place only under anaerobic conditions
- b. take place only at lower temperature
- c. are anabolic metabolic pathways
- d. obtain the energy from a cleavage of high-energy bonds

447. Krebs cycle:

- a. takes place in mitochondria, where enzymes and transmitters of oxidoreductases occur
- b. takes place in ribosomes
- c. despite its catabolic effect, it belongs to amphibolic pathways
- d. is used in the body as the main source of energy

448. What is the citric acid cycle importance?

- a. its intermediates are used as precursors for e. g. non-essential fatty acids, fatty acids and cholesterol biosynthesis, in an organism
- b. during the process, the reduced coenzymes NADH and  $\text{FADH}_2$  are produced
- c. it is the energy source for whole organism
- d. it is the source of citric acid

449. What types of reactions do take place in the citric acid cycle?

- a. phosphorylations
- b. deaminations
- c. dehydrogenations
- d. decarboxylations

450. We can say about citric acid cycle:

- a. it begins by the condensation of acetyl-CoA and oxaloacetic acid
- b. the product of the condensation of acetyl-CoA and oxaloacetic acid is citric acid
- c. the product of the hydrolysis of citric acid is 2-oxoglutaric acid
- d. the product of the dehydrogenation and decarboxylation of 2-oxoglutaric acid is oxaloacetic acid

451. Citric acid cycle:

- a. occurs in the cytoplasm
- b. occurs in the mitochondria
- c. is localized in ribosomes
- d. occurs in the cell nucleus

452. What processes do take place during the process of glycolysis?

- a. the phosphorylation of glucose in the presence of  $H_3PO_4$
- b. the activation and phosphorylation of glucose in the presence of ATP to prevent the glucose passing through the membrane
- c. glucose-6-phosphate formation
- d. the isomerization of glucose to galactose

453. Glycolysis:

- a. occurs in the mitochondria
- b. is localized in the cytoplasm
- c. is localized in ribosomes
- d. occurs also in cell nucleus

454. We can say about pyruvic acid:

- a. the product of the pyruvic acid reduction under anaerobic conditions is lactic acid
- b. the product of the decarboxylation of pyruvic acid under aerobic condition in living organism is acetaldehyde
- c. the product of the decarboxylation and oxidation of pyruvic acid under aerobic conditions is acetyl-CoA, that enters citric acid cycle and other respiration processes
- d. is produced by lactic acid reduction

455. What reactions of glycolysis process are irreversible?

- a. the reaction of glucose with ATP, where glucose-6-phosphate is formed
- b. the reaction of fructose with ATP, where fructose-1, 6-biphosphate is formed
- c. the oxidation of lactic acid, where pyruvic acid is formed
- d. the reaction of dihydroxyacetone phosphate, where glyceraldehyde 3-phosphate is formed

456. Lipids:

- a. are produced also by saccharides conversion, when there is a excessive saccharide intake into the organism
- b. the product of their cleavage by a lipase (enzyme) is glycerol and long chained fatty acids
- c. they are cleaved into acetyl-CoA in the stomach
- d. cannot be synthesized by the organism, and therefore they must be supplied in the diet

457. Lipids:

- a. can be substituted by saccharides in the organism
- b. they provide the environment suitable for water insoluble substances, that are dissolved here (in lipids), for example B vitamin group
- c. are the important components of cell membranes
- d. they protect vital organs of human body

458. What does occur in the molecule of lipid?

- a. a carboxyl acid with 15 carbon atoms in a chain
- b. a carboxyl acid with an even number of carbon atoms in a chain
- c. branched carboxyl acid
- d. for example, linoleic acid, stearic acid, arachidonic acid

459. Acylglycerol:

- a. there is only fatty acid bound to tribasic alcohol by the peptide bond in its molecule
- b. there is only fatty acid bound to tribasic alcohol by the ester bond in its molecule
- c. there is also choline in its molecule
- d. it does have the phosphoester bond formed in its molecule

460. Lipids rancidity (ageing):

- a. is the oxidation of multiple bonds by air oxygen, at which the long chains of fatty acids are broken
- b. is caused also by microorganisms in warm, moist environment
- c. we can avoid the lipids rancidity by lipids dehydrogenation in the presence of catalyst
- d. we can slow down the lipids rancidity by addition of A vitamin or  $\beta$ -carotene

461. We can say about triacylglycerols:

- a. the product of the acidic hydrolysis of triacylglycerols is a soap
- b. according to the alcohol content, they can be simple or mixed
- c. according to the fatty acid content, they can be simple or mixed
- d. the product of the alkaline hydrolysis of triacylglycerols is a soap

462. Acetyl-CoA cannot be used for synthesis of:

- a. oleic acid
- b. estradiol
- c. heme
- d. cholic acid

463. The end product of protein metabolism in human body is:

- a. urea
- b. uric acid
- c. ammonia
- d. diamide of carbonic acid

464. The end product of purine bases is:

- a. iminourea
- b. carbamic acid
- c. uric acid
- d. urea

465. We can say about vitamins:

- a. essential vitamins for humans are not always essential for animals and microorganisms
- b. they are an energy source for organism
- c. according to the origin, they can be divided into 2 groups – phyto- and zoo-
- d. according to the solubility, they can be divided into water-soluble and fat-soluble

466. Hypervitaminosis:

- a. it does not cause the side effect, because vitamins are not cumulated in the organism
- b. can have a toxic effect, if concerned fat-soluble vitamins
- c. causes side effect, if concerned water-soluble vitamins
- d. never have the side effect (adverse effect), because vitamins are just coenzymes and are almost not involved in biochemical processes

467. Hypovitaminosis:

- a. is an actual vitamin deficiency
- b. is an ineffective vitamin form
- c. is an actual excess of a vitamin
- d. is a long-term vitamin deficiency

468. Avitaminosis:

- a. is chronic vitamin deficiency
- b. can cause serious disease, sometimes death
- c. occurs, when vitamin mass descend under 0. 15% of total body mass
- d. is just temporal vitamin deficiency

469. A vitamin:

- a. is produced by symmetric cleavage of the  $\beta$ -carotene molecule in the organism
- b. vitamin A deficiency causes rchachitis
- c. hypovitaminosis causes night blindness
- d. the overdose is toxic

470. What chemicals are antioxidants?

- a. vitamin A, E, C and selenium
- b. Zn, Mg and C vitamin
- c. Na, K and C vitamin
- d. only C vitamin

471. We can say about vitamins D and E:

- a. they have a steroid structure
- b. tocopherol acts as an antioxidant
- c. vitamin D supports the absorption of calcium and phosphorus from food
- d. vitamin D supports the release of calcium and phosphorus from the bones and teeth

472. B<sub>1</sub> vitamin:

- a. regulates an oxidation of nutrients, and energy procurement
- b. is a part of FAD
- c. provides an energy for central nervous system
- d. is thermostable

473. B<sub>2</sub> vitamin:

- a. is pyridine derivative
- b. is a part of coenzyme of aminotransferases
- c. occurs only in the plant material
- d. is converted into nicotinamide in the organismsm

474. Anemia can be caused by the:

- a. vitamin F deficiency
- b. niacin deficiency
- c. cobalamin deficiency
- d. folic acid deficiency

475. What chemical gives a positive biuret reaction?

- a. vasopressin
- b. insulin
- c. calcitonin
- d. thyroxine

476. How many molecules of sodium hydroxide are there in 25g?

- a.  $6.022 \cdot 10^{26}$
- b.  $3.76 \cdot 10^{23}$
- c.  $1.03 \cdot 10^{-23}$
- d.  $376 \cdot 10^{21}$

477. Acetyl-CoA:

- a. Is generated as the cleavage by-product of saccharides, lipids and proteins
- b. Is non active acetic acid
- c. Does not contain the macroergic bond
- d. In the citrate cycle, it condenses with oxaloacetic acid to generate citric acid

478. Lysine has  $M_r = 220$ . How much nitrogen is there in 220 mg of lysine?

- a. 14 mg
- b. 28 mg
- c. 0.028 g
- d. there is no nitrogen in the lysine molecule

479. Purine has  $M_r = 120$ . How much nitrogen is there in 240  $\mu\text{g}$  of purine?

- a. 112 micrograms
- b. 56 . micrograms
- c. 28 micrograms
- d. 224 micrograms

480. Calculate the chemical amount (amount of substance) and the volume of 100 g of carbon dioxide:

- a. 2.27 mol
- b. 0.44 mol
- c. 50.9  $\text{dm}^3$
- d. 101 ml

481. What is the weight of 22.4 ml of nitrogen ( $A_r = 14$ ) under normal conditions?

- a. 14 mg
- b. 140 mg
- c. 28 mg
- d. 280 mg

482. What is the weight of 11.2 ml of fluorine?

- a. 9 g
- b. 9 mg
- c. 19 mg
- d. 18 g

483. How many grams of oxygen are there in 45 g of sodium carbonate?

- a. 6.79 g
- b. 14.11 g
- c. 20.38 g
- d. it is not possible to calculate it from these data

484. How much heat is required to produce 100 g of burnt lime ( $\Delta H = 178 \text{ kJ/mol}$ )?

- a. 317.86 kJ/mol
- b. 17.8 MJ/mol
- c. 317.86 MJ/mol
- d. 17.8 kJ/mol

485. 50 l of ethanol burning releases 3. 092 MJ. Calculate the heat of the reaction:

- a. 2862. 96 kJ
- b. 1386. 54 kJ
- c. 1386. 54 kJ/mol
- d. 2862. 96 kJ/mol

486. The reaction of 3 mol of sulphuric acid and 10 mol of sodium hydroxide gives rise to:

- a. 3 mol of sodium sulphate
- b. 6 mol of sodium sulphate
- c. 10 mol of sodium sulphate
- d. 6 mol of NaSO<sub>4</sub>

487. If 44. 8 ml of methane reacts with oxygen, the volume of carbon dioxide (product) is:

- a. 1 mmol
- b. 2 mmol
- c. 3 mmol
- d. 4 mmol

488. If 5 mmol of propane reacts with oxygen, the volume of carbon dioxide (product) is:

- a. 5 mmol
- b. 10 mmol
- c. 15 mmol
- d. 30 mmol

489. How many grams of glucose do you need to make 350 ml of solution with  $c=0. 25 \text{ mol/l}$ . ?  $M(\text{glucose})=180. 16 \text{ g/mol}$ :

- a. 15. 77 g
- b. 128. 70 g
- c. 0. 128 g
- d. 157. 64 g

490. How many grams or millilitres of nitric acid ( $w=68\%$ ;  $\rho=1. 4 \text{ g/cm}^3$ ) do you need to make 500 ml of solution with  $c=0. 2 \text{ mol/l}$ . ?  $M_r(\text{HNO}_3)=63$ :

- a. 6. 3 g
- b. 9. 26 g
- c. 6. 61 ml
- d. 4. 5 ml

491. How much water do you need to add to the 150 g of 35% sodium hydroxide solution to prepare 12% solution?

- a. 106. 25 g
- b. 587. 5 g
- c. 287. 5 g
- d. 300 g

492. If 160 g of water vaporizes from 800 g of 8% solution of KCl, what will be the final concentration of the solution?

- a. 10%
- b. 16%
- c. 8%
- d. 0. 1

493. How much of NaOH do you need to make 25 ml of 0.001 mol/dm<sup>3</sup> solution?

- a. 25 μmol
- b. 1 mg
- c. 0.1 g
- d. 100 mg

494. If 320 g of water vaporizes from 850 g of calcium chloride solution (w=20%), and simultaneously 50 g of CaCl<sub>2</sub> precipitates, what will be the final concentration of the solution?

- a. 30%
- b. 25%
- c. 35.4%
- d. 22.6%

495. How much oxygen and air do you need to burn 7 l of acetylene?

- a. 25 g; 17.5 l of oxygen
- b. 10 g; 7 l of oxygen
- c. 47.62 g; 33.33 l of air
- d. 119 g; 83.33 l of air

496. Iron is produced by the reduction of iron oxide by carbon. How much iron oxide and iron ore do you need to make 5t of iron, if there is 23% Fe<sub>2</sub>O<sub>3</sub> in the iron ore?

- a. 7.136 t of Fe<sub>2</sub>O<sub>3</sub>
- b. 31 t of iron ore
- c. 14.3 t of Fe<sub>2</sub>O<sub>3</sub>
- d. 62 t of iron ore

497. In the equilibrium state of the reaction of  $2\text{N}_2 + 3\text{O}_2 \leftrightarrow 2\text{N}_2\text{O}_3$  the concentrations 2.3 mol/dm<sup>3</sup> of nitrogen, 1.05 mol/dm<sup>3</sup> of oxygen and 3.42 mol/dm<sup>3</sup> of dinitrogen trioxide were detected. Calculate the equilibrium constant? What were the initial concentrations of oxygen and nitrogen?

- a. [N<sub>2</sub>]=5.73 mol/dm<sup>3</sup>; [O<sub>2</sub>]=6.18 mol/dm<sup>3</sup>
- b. [N<sub>2</sub>]=4.01 mol/dm<sup>3</sup>; [O<sub>2</sub>]=2.29 mol/dm<sup>3</sup>
- c. K=0.524
- d. K=1.909

498. What will be the osmotic pressure of aluminium acetate at the temperature 25° C, if in 500 ml of its solution there is 5 g of the substance? (R=8.32 J/K. mol):

- a. 0.479 kPa
- b. 479.02 kPa
- c. 239.51 kPa
- d. 40.16 kPa

499. Physiological solution:

- a. is isotonic having the composition of the cell's content
- b. cells isolated from the liver alter in it the cell's volume
- c. is isotonic in the saccharose solution with the concentration of 0.15 mol . l<sup>-1</sup>
- d. is the saccharose solution

500 Metabolic pathway:

- a. is the series of biochemical reactions, that are connected by their intermediates
- b. is the series of reactions, whereby the product of one reaction is the substrate for the follow up reaction
- c. is for example neutralisation reaction or complexation reaction
- d. is always reversible