# If NaCl is dissolved in distilled water in a beaker, the following item is formed:

1. a colorless solution
2. a closed system
3. a true solution
4. a solution of electrolyte
5. an open system
6. an isolated system
7. a chemically pure substance
8. a homogeneous system

# Distilled water differs from drinking water:

1. in its chemical composition
2. in the content of anions
3. in the content of cations
4. in the fact that the distilled water is the strong electrolyte and drinking water is the weak electrolyte
5. in the fact that the drinking water is a chemical individual and distilled water is not a chemical individual
6. it does not differ
7. in the fact that the distilled water is a chemically pure substance and drinking water is a chemical individual
8. in the ability to form hydrogen bonds

# Drinking water:

1. is a true solution
2. consists only of H2O molecules
3. is a homogeneous mixture
4. is a mixture of chemical substances
5. is not a true solution
6. is a suspension
7. is a chemical individual
8. is a heterogeneous mixture

# Electrons:

1. of the same atoms are involved in the formation of a nonpolar covalent bond (for example in N2 molecule)
2. with the lowest energy are referred to as electrons in the ground state
3. occupy individual energy levels in the atom by filling the highest energy level first
4. can be removed from the atom forming anions
5. belong to the elementary particles with a negative charge
6. their number in the atom is always equal to the number of neutrons
7. in atoms are in the regions called orbitals
8. in the outermost electron shell of the atom are called the valence electrons

# An elementary structural unit of the substance is:

1. a proton
2. an electron
3. an atom
4. a nucleon
5. a matter
6. a compound
7. each chemical individual
8. a molecule, for example, H2

# A chemical individual can be:

1. a solution of NaCl in distilled water
2. only a compound
3. Al2O3
4. an electron
5. drinking water
6. sea water
7. an element or a compound
8. only an element

# Nuclides

1. are isotopes
2. have the same number of protons
3. have the same number of neutrons
4. have a different number of nucleons
5. have a different number of electrons
6. have a different number of neutrons
7. have a different number of protons
8. have the same atomic number

# Nuclides :

1. can be found in nature in the same amount
2. have the same number of neutrons
3. have the same number of nucleons
4. are isotopes
5. have the same number of electrons
6. have the same atomic and mass numbers
7. do not differ in the electron configuration
8. all have the same mass

# Protium, deuterium and tritium:

1. differ in their atomic number
2. differ in their mass number
3. differ in the number of protons
4. differ in the number of neutrons
5. differ in the number of electrons
6. are isotopes of water
7. are different names of the same isotope
8. differ in the relative atomic mass

# The maximum number of electrons in the shell with principal quantum number ***n* = 2 is:**

1. 2
2. 8
3. 18
4. 32
5. possible to calculate from the relation 2*n*2
6. 6
7. 12
8. 16

# The electron shell M can possess:

1. 16 electrons at the most
2. only *p* orbitals
3. only *s* and *p* orbitals
4. *s*, *p*, *d* orbitals
5. 12 electrons at the most
6. 18 electrons at the most
7. 8 electrons at the most
8. 2*n*2 electrons, where *n* = the principal quantum number

# Neutron:

1. is a particle the mass of which is approximately equal to the mass of hydrogen molecule
2. is a particle which has only one elementary positive charge
3. is an electrically uncharged particle
4. has the mass approximately equal to the mass of the proton
5. is one of the elementary particles of the electron shell
6. is one of two types of elementary particles in the atomic nucleus
7. is the basic structural unit of the substance
8. does not belong to nucleons

# According to the Pauli principle:

1. in a *p*x orbital there can be 1 electron at the most
2. in a *p*y orbital can be 2 electrons at the most
3. in a *p*y orbital there can be 6 electrons at the most
4. in a *p*z orbital there can be 10 electrons at the most
5. in an *s* orbital there can be 1 electron at the most
6. in an *s* orbital there can be 2 electrons at the most
7. in orbitals *d* there can be 10 electrons at the most
8. in the orbital there can be 2 electrons with an antiparallel spin at the most

# The energy needed for the cleavage of a certain chemical bond:

1. is the same as the activation energy
2. is the same as the energy released during its formation
3. is higher than the energy released during its formation
4. is the same as the ionization energy
5. is the dissociation energy of a bond
6. is also called the bond energy
7. is given, e.g. in kJ.mol-1
8. is lower than the energy released during its formation

# In the molecule of hydrogen peroxide:

1. the atom of oxygen has an oxidation state of -II
2. the atom of oxygen has an oxidation state of -I
3. a valency of oxygen atom is 1
4. the atom of hydrogen has an oxidation state of -I
5. the atom of hydrogen has an oxidation state of I
6. the atom of hydrogen has an oxidation state of II
7. a valency of oxygen atom is 2
8. the atoms of oxygen and hydrogen are bound by the covalent bond

# Ionic compounds:

1. most of them are not soluble in water
2. most of them are soluble in water
3. have the structure in which cations and anions are attracted by electrostatic forces
4. as melts or in solutions conduct electric current
5. are those for which a covalent bond between elements is typical
6. are those for which an electronegativity difference of combined elements is higher than 1.7
7. dissociate into ions in water
8. are electrolytes in the water solution

# Cations are ions which:

1. can move to the cathode in the direct electric field
2. have a positive charge
3. can move to the anode in the direct electric field
4. cannot be formed from atoms of alkali metals
5. are easily formed from elements with the low electronegativity
6. have more protons than electrons
7. are formed from atoms of elements after the loss of 1 or more electrons
8. are easily formed from elements with the low ionization energy

# If both electrons of the covalent bond are provided only by one atom, the bond is:

1. coordinate
2. donor-acceptor
3. metallic
4. covalent nonpolar
5. hydrogen
6. ionic
7. present for example in NH4+
8. typical for ionic compounds

# In NH4Cl between individual atoms following bonds can occur:

1. ionic
2. donor-acceptor
3. covalent
4. hydrogen
5. coordinate
6. metallic
7. van der Waals
8. σ and π

# A single covalent bond:

1. is between C-C and C-H atoms of alkanes
2. is in H2 molecule
3. can be formed, if the difference of electronegativities between bound atoms is higher than 1.7
4. is for example in the NaCl molecule
5. is in the molecule of ethane
6. is in the molecule of ethyne between carbon atoms
7. is formed, when both atoms are involved in the formation of the bonding electron pair
8. is between nitrogen atoms in N2 molecule

# A hydrogen bond:

1. is also called the hydrogen bridge
2. is stronger than the covalent bond
3. is formed between molecules (groups) that contain hydrogen atoms bound to the strong electronegative elements (mainly F, O, N)
4. is formed in protein molecules
5. is formed in nucleic acid molecules
6. is present in a water molecule
7. between molecules of the same compound is the reason for its higher boiling point
8. is typical for water molecules in the gaseous state

# In simple proteins following bonds are present:

1. covalent
2. hemiacetal
3. ester
4. hydrogen
5. amide
6. peptide
7. N-glycosidic
8. O-glycosidic

# Hydrogen bonds are formed:

1. in the molecules of DNA
2. between the molecules of H2O
3. between the molecules of NH3
4. between the molecules of CH4
5. between the molecules of C2H5OH
6. between the molecules of CH3-O-CH2-CH3
7. between the molecules of HF
8. in the molecules of proteins and they stabilize their secondary structure

# Van der Waals forces:

1. are formed between anions and cations
2. are based on mutual effects of molecular dipoles
3. are about 100 times weaker than covalent bonds
4. occur between the central atom and ligands in complexes
5. are in the molecules of proteins
6. are strong bonds
7. are responsible for the primary protein structure
8. are intermolecular forces

# A molecule:

1. can be formed by two or more atoms
2. is always formed only by atoms of the same type
3. is a relatively stable cluster of atoms bound by chemical bonds
4. can be formed by atoms of the same type
5. of boron trifluoride has 4 bonding electron pairs
6. of methane has the atomic nucleus of carbon in the middle of the regular tetrahedron
7. is always nonpolar if it consists of atoms of different electronegativities
8. can be linear or bent if it consists of three atoms

# Assign symbols for the Latin names of these elements - stibium, stannum, aluminium, magnesium, silicium, selenium:

1. At, Sn, Al, Mn, S, Se
2. Sb, Sn, Al, Mg, Si, Sl
3. Sb, Sn, Am, Mg, Si, Sn
4. Sb, Sn, Al, Mn, Si, Se
5. Sb, St, Al, Mn, Si, Se
6. St, Sn, Au, Mg, Si, Se
7. Sb, Sn, Al, Mg, Si, Se
8. St, Sn, Au, Mg, Sl, Se

# What are the oxidation numbers of elements in listed oxides if oxidation number of oxygen atom is -II: Mn2O7, HgO, Ag2O, P4O6, N2O5, SO3, SiO2:

1. V, I, II, III, V, IV, VI
2. VII, II, II, III, V, VI, IV
3. VII, II, I, III, V, IV, VI
4. VII, I, II, II, V, IV, VI
5. V, IV, II, III, V, IV, VI
6. I, VII, III, IV, VI, IV, IV
7. VII, II, I, III, V, VI, IV
8. V, II, I, III, V, VI, IV

# Select the correct statement about hydroxides with the general formula M(OH)n:

1. M is an atom of metal and n is 1 - 7
2. M is an atom of metal and n is 1 - 4
3. OH- is the hydroxide ion
4. OH- is the hydroxonium ion
5. they can be formed by the reaction of base-forming oxides with water
6. according to Brönsted theory they are proton donors
7. in the reaction with acids they form salts
8. their water solutions have pH > 7

# The ionization energy:

1. is the energy required to remove an electron from an atom in the gaseous state
2. informs us how strongly an electron is bound in an atom
3. of alkali metals (Li, Na, K) is high
4. is related to the energy of an electron in an atom so that the lower energy of an electron the higher ionization energy
5. is given, e.g. in kJ.mol-1
6. is low for metals which are easily reduced
7. is low for metals which are easily oxidized
8. reflects how easily cation can be formed from an atom

# The electron shell with the principal quantum number *n* = 3 can contain:

1. *s, p* orbitals
2. *s* orbitals
3. *s, p, d* orbitals
4. *s, p, d, f* orbitals
5. only *p* orbitals
6. orbitals with 18 electrons at most
7. orbitals with 8 electrons at most
8. only *d* orbitals

# In starch molecules, the following bonds can occur:

1. α(1-4) glycosidic
2. α(1-6) glycosidic
3. ß(1-4) glycosidic
4. N-glycosidic
5. O-glycosidic
6. amide
7. α(2-6) glycosidic
8. the same as in glycogen molecules

# In the molecule of CH2 = CH2, the following bonds are present:

1. 2 σ and 2 π bonds
2. 1 σ and 1 π bond
3. 5 σ and 1 π bond
4. 1 σ and 3 π bonds
5. 5 σ and 2 π bonds
6. 1 σ and 5 π bonds
7. 2 σ and 3 π bonds
8. 5 σ and 3 π bonds

# A single bond:

1. is, e.g. the covalent bond in the molecules of H2 and F2
2. consists of two electron pairs
3. can be formed by overlapping of two *s* orbitals
4. can be formed by overlapping of *s* and *p* orbitals
5. is typical for saturated hydrocarbons
6. is more reactive than the double bond
7. is stronger than the triple bond
8. between atoms is formed by a common electron pair

# A double bond:

1. is formed by sigma and pi bonds (σ and π)
2. is formed by one electron pair
3. can be found in molecules of long-chain carboxylic acids
4. can be a part of the conjugated system
5. can be converted into a single bond by an addition reaction
6. can be converted into a triple bond by an elimination reaction
7. is more reactive than a single bond
8. is present in the fumaric acid molecule

# Glycosidic bonds:

1. α(1-4) occur in the molecule of starch
2. are formed during the oxidation of saccharides
3. α(1-6) occur in the molecule of glycogen
4. can be O-glycosidic
5. occur in molecules of, e.g. starch, glycogen, nucleotides
6. can be σ and π
7. can be N-glycosidic
8. are also found in nucleosides

# According to the Brönsted theory, acids are:

1. substances which can release a proton
2. all substances that can color phenolphthalein to red violet
3. substances which can release the atom of hydrogen
4. substances able to cleave off H2
5. proton donors
6. all substances that are ionized in water to form hydroxide anions
7. only electroneutral molecules that can release H+
8. electroneutral molecules and some ions (e.g. HCO3-, H2PO4-), which may be donors of H+

# According to the Brönsted theory, bases are:

1. all substances that can color the litmus paper to the red in water solution
2. proton acceptors
3. substances which can accept a proton
4. all compounds with -OH group in their molecule
5. only compounds that can cleave off the OH- anion in water
6. only the substances of alkali-forming oxides with water
7. also anions of polyprotic acids that can accept a proton
8. e.g. NH3, CH3COO-, Cl-, NH4+, C6H5NH3+

# Which of the following pairs are conjugated pairs of the following protolytic reaction NH3 + HCl NH4+ + Cl- :

1. HCl and NH4+
2. NH3 and Cl-
3. NH3 and NH4+
4. NH3 and NH4Cl
5. HCl and Cl-
6. NH3 and HCl
7. NH4+ and Cl-
8. HCl and NH4Cl

# The strength of acids decreases in the following order: **HClO4 > HClO3 > HClO2 > HClO. Which of the following statements is true:**

1. the polarity of O-H bond increases
2. the pK value of acids increases
3. the value of the ionization (dissociation) constant decreases
4. all values of ionization constants (K) are the same
5. the value of the degree of ionization α decreases
6. there is the same polarity of O-H bonds
7. there are the same pK values for acids
8. the K value increases

# The electrolytic ionization (dissociation) occurs when:

1. the number of particles in the volume unit of the solution is increased compared to the original number of molecules after the dissolution of the electrolyte
2. after the dissolution of the electrolyte, the osmotic pressure decreases in the solution
3. the soluble salt breaks down in the aqueous solution to give the oppositely charged ions
4. during the dissolution the compound stays unchanged in the solution
5. the substance in the solvent decomposes to cations and anions
6. a crystal lattice decomposes into molecules in the solution
7. the ion secretion occurs on the electrodes
8. the dissolved substance in the form of the molecules is evenly dispersed throughout the solution

# The strength of acids and bases:

1. is assessed according to the solvent in which they are prepared
2. is determined according to the value of osmotic pressure *π* of acid or base solution
3. is determined according to the value of their ionization constant
4. is determined by the value of their isoelectric point
5. is determined by the pH value of their solutions
6. is determined by the pK value
7. is determined by the value of the degree of ionization α
8. is determined by their concentration

# The solution is acidic if:

1. pH = 4.8
2. pOH = 11.9
3. pOH > 7
4. pH < 6
5. pH > 8
6. pOH < 6
7. pH = 7
8. pOH = 7

# The solution is alkaline if:

1. pOH < 7
2. pH < 6
3. pOH = 4.5
4. pOH > 7
5. pH = 5.5
6. pOH = 13
7. pOH = 7
8. pH = 9

# The solution is alkaline if:

1. *c*(H3O+) = 2×10-8 mol.l-1
2. *c*(OH-) = 7×10-10 mol.l-1
3. *c*(H3O+) = 1×10-7 mol.l-1
4. *c*(H3O+) = 7×10-1 mol.l-1
5. *c*(H3O+) = 1×10-6 mol.l-1
6. *c*(OH-) = 1×10-7 mol.l-1
7. *c*(OH-) = 7×10-3 mol.l-1
8. *c*(H3O+) = 2×10-12 mol.l-1

# The solution is acidic if:

a) *c*(OH-) = 4×10-12 mol.dm-3

b) *c*(H3O+) = 7×10-5 mol.dm-3

c) *c*(OH-) = 3×10-5 mol.dm-3

d) *c*(H3O+) = 7×10-10 mol.dm-3

e) *c*(OH-) = 1×10-7 mol.dm-3

f) *c*(H3O+) = 1×10-7 mol.dm-3

g) *c*(H3O+) = 7×10-2 mol.dm-3

h) *c*(OH-) = 8×10-9 mol.dm-3

# If the acidity constant of the nitrous acid is 4.5×10-4, (log 4.5 = 0.65) then the following statement is true:

1. the nitrous acid is a weak acid
2. the nitrous acid is a strong acid
3. the nitrous acid is a weak electrolyte
4. the HNO2 solution can react only with weak bases
5. the pK value is 3.35
6. the pK value is 4.65
7. in its aqueous solution only H3O+ and NO2- ions will occur
8. in the aqueous solution, the equilibrium between HNO2 molecules and NO2- and H3O+ ions can be expressed by the equilibrium constant

# The ionization constant of the base:

1. always has the same value as the ionization constant of the conjugate acid
2. always has the same value as the autoprotolytic constant of water
3. characterizes the ability to attract the proton
4. determines the strength of a base
5. has the same value as the degree of ionization of the base
6. characterizes the ability to cleave off the proton
7. indicates the solubility of a base in the given solvent
8. indicates the amount of OH- ions in the solution of a base

# If we dissolve in water (pH water = 7) the salt:

1. KClO, the pH of the resulting solution will be higher than 7
2. sodium formate, the pH of the resulting solution will be in the acidic area
3. the pH of the solution will depend only on the salt concentration and not on its composition
4. of a strong base with a weak acid - the pOH of this solution will be less than 7
5. of a weak base with a strong acid - the pH of this solution will be less than 7
6. pH of the solution will always be 7
7. of a strong base with a weak acid - original pH does not change (i.e., pH = 7)
8. of a strong acid with a strong base - salt hydrolysis occurs, and the pH of the solution will always be less than 7

# After the dissolution of KCN in water (pH of water = 7):

1. a partial reaction cannot occur: CN- + H2O HCN + OH-
2. the ionization of the salt occurs in the solution
3. the initial pH value of the water will not change
4. pOH of the resulting solution will be less than 7
5. only KCN and H2O molecules will be present in the resulting solution
6. the salt is hydrolyzed in the solution
7. pH of the resulting solution is acidic
8. the litmus paper will change its color to red

# Which of the following pairs of salt solutions almost do not undergo hydrolysis:

1. K2SO3, BiCl3
2. RbCl, Na2SO4
3. NaCN, (NH4)2S
4. Li2SO4, NaClO4
5. Cs2SO3, KF
6. CH3COOK, K2HPO4
7. K2SO4, NaCl
8. Na2S, KCN

# Protolytic reactions:

1. are reactions in which acids react with non-noble metals to form hydrogen
2. are reactions in which bases and salts accept the -OH groups
3. are essential for the acid ionization in which the acid reacts with molecules of water
4. are reactions in which the base releases and the acid accepts the proton
5. are reactions in which salts in the solution are ionized, and electrodes are covered by metals
6. are called hydrolysis in which the salt ions react with water
7. are opposite to electrolysis
8. are reactions in which the acid releases and the base accepts the proton

# According to the Brönsted theory, acids can be:

1. e.g. HCO3-, HSO4-, OH-, PO43- ions
2. only electroneutral molecules
3. only cations, e.g. NH4+
4. electroneutral molecules, cations and anions that can release H+
5. only substances with more hydrogen atoms per molecule
6. proton donor substances
7. substances with more oxygen atoms per a molecule
8. e.g. HSO3-, H2PO4-, HS- ions

# The strong and weak bases differ:

1. in the number of -OH groups that they can accept from another molecule
2. in their solubility in water
3. in their concentration in non-aqueous solvents
4. in the number of -OH groups in their molecules
5. in ionization constants
6. in the ability to accept a proton
7. in the values of ionization degrees
8. in the ability to donate a proton

# Select groups of compounds that behave as electrolytes in aqueous solutions:

1. CoCl2, Na2CO3, CHCl3, HCl, C2H6
2. CH4, benzene, KMnO4, CH3COOH, K2SO4
3. FeCl3, H2SO4, NaBr, CH3COOK, NH4Br
4. CuSO4, HI, NaNO3, K3[Fe(CN)6]
5. KCN, Na2CO3, C6H6, glucose, CH2Cl2
6. KCl, CH3COOK, NaI, (NH4)2S, FeCl2
7. fructose, CH2Cl2, KBr, NiCl2, toluene
8. CH4, chloroform, HCl, NaOH, H2S

# The value of the product of ion concentrations of H3O+ and OH- (Kw):

1. is related to the pH value as follows: pH + pOH = pKw
2. is the same in all aqueous solutions at the given temperature
3. does not change with the temperature change
4. is also called the solubility constant
5. is Kw = 1×10-14 mol2.l-2 at 25 °C
6. is also called the autoprotolytic constant of water
7. can be converted into a logarithmic scale as follows: pKw = - log Kw
8. is also called the ionic product of water

# True solutions are:

1. only solutions of strong electrolytes
2. those, in which the size of dissolved particles is larger than 1×10-9 m
3. crude dispersion systems of a liquid and solid substance
4. homogeneous mixtures of a gas and solid substance
5. only aqueous solutions of inorganic compounds
6. those, in which the size of dissolved molecules (particles) is less than 1 nm
7. e.g. egg white or starch solutions
8. e.g. fructose and physiological saline solutions

# Osmotic pressure:

1. is the pressure to be applied to the surface of the solution to prevent dialysis
2. can be used to determine the molar mass of the solute (especially for macromolecular substances) by the relation: where *M* = molar mass of the solute, *m* = weight of the solute, *V* = the solution volume



1. is mainly caused by mineral salts in human blood
2. of electrolytes is smaller than of non-electrolytes at the same concentration (mol.l-1)
3. is determined by the external pressure applied to the more concentrated solution to prevent the solvent from entering the solution through the semipermeable membrane
4. manifests if the red blood cells are put into the hypotonic environment - their hemolysis occurs
5. is the same in glucose solution, *c* = 0.3 mol.l-1, and NaCl solution, *c* = 0.3 mol.l-1
6. does not depend on the structure of substances but the number of particles formed in the solution after the dissolution of the electrolyte in the given solvent and its ionization

# Which of the following statements about osmosis is true:

1. in humans, the osmosis is important during the administration of injections into a vein
2. from the aqueous solution the hemoglobin can be separated from NaCl by osmosis
3. it is a process that allows protein molecules to pass from the outside space into the cell
4. the concentration of the substance in the more concentrated solution decreases as a result of osmosis
5. if we put red blood cells into NaCl solution with concentration *c* = 0.3 mol.l-1, they will remain unchanged
6. if a semipermeable membrane separates the solution and solvent, the solvent penetrates into the solution
7. it is a process in which the concentration of the concentrated solution is increased
8. it occurs when two solutions of different concentration (molecules, ions) are separated by a semipermeable membrane

# An aqueous solution of AgNO3 (Mr = 170) at the concentration of 0.5 mol.l-1 contains:

1. 0.25 mol AgNO3 in 50 milliliters of the solution
2. 1 mol AgNO3 in two liters of water
3. 0.5 mmol AgNO3 in one milliliter of the solution
4. 85 mg AgNO3 in one cm3 of the solution
5. 0.25 mol AgNO3 in 0.5 dm3 of water
6. 2 mol AgNO3 in 4,000 ml of the solution
7. 170 g AgNO3 in 2,000 ml of the solution
8. 170 g AgNO3 in one dm3 of the solution

# There are three aqueous solutions: A (NiCl2), *c* = 0.1 mol.l-1; B (KCl),

***c* = 0.15 mol.l-1; C (sucrose), *c* = 0.3 mol.l-1. Select the correct statement:**

1. the solution C has the greatest osmotic pressure
2. the solution A has the lowest osmotic pressure
3. in all these solutions there is the same osmotic pressure
4. the solution B has the higher osmotic pressure than solution A
5. the solution C is hypertonic to solution B
6. the solution B is hypertonic to solution A
7. solutions A, B and C are isotonic
8. the solution A is hypotonic to solution C

# The water solution of FeCl3 with the weight fraction *w*(FeCl3) = 0.008 may contain:

1. 0.8 g of FeCl3 in 100 g of solution
2. 1.6 g of FeCl3 and 200 g of water
3. 0.8 g of FeCl3 in 1000 g of the solution
4. 2 g of FeCl3 in 250 g of the solution
5. 0.008 % of FeCl3
6. 8 % of FeCl3
7. 4 g of FeCl3 and 496 g of H2O
8. 800 mg of FeCl3 and 99.2 g of H2O

# There is a physiological solution of NaCl (*c* = 0.15 mol.l-1). Select the solution which is isotonic with NaCl solution:

1. CuSO4, *c* = 0.1 mol.l-1
2. fructose, *c* = 0.3 mol.l-1
3. NiCl2, *c* = 0.15 mol.l-1
4. CdSO4, *c* = 0.15 mol.l-1
5. KNO3, *c* = 300 mmol.l-1
6. FeCl2, *c* = 100 mmol.l-1
7. sucrose, *c* = 0.15 mol.l-1
8. FeCl3, *c* = 75 mmol.l-1

# There is a Ba(NO3)2 solution with a concentration of 0.2 mol.l-1. Select a solution which is hypertonic compared to the Ba(NO3)2 solution:

1. AgNO3, *c* = 0.5 mol.l-1
2. FeSO4, *c* = 300 mmol.l -1
3. Fe2(SO4)3, *c* = 0.15 mol.l -1
4. NiCl2, *c* = 300 mmol.l -1
5. KMnO4, *c* = 0.3 mol.l -1
6. ZnI2, *c* = 0.4 mol.l -1
7. fructose, *c* = 0.6 mol.l -1
8. KIO3, *c* = 0.25 mol.l -1

# Diffusion:

1. is the opposite of osmosis
2. may occur, e.g. when we insert a KMnO4 crystal into the beaker with water
3. is the passage of the solvent through the semi-permeable membrane
4. is the passage of the low-molecular weight particles through the semi-permeable membrane
5. is the spontaneous passage of particles of the substance from the area with a higher concentration into the area with a lower concentration
6. is the passage of the solvent from the area with a higher substance concentration into the area with a lower concentration
7. occurs in the system of two solutions separated by a semi-permeable membrane
8. is the opposite of dialysis

# The physiological solution is the water solution of NaCl (Mr = 58) with a concentration of 0.15 mol.l-1. It may contain:

1. 30 mmol of NaCl in 200 ml of the solution
2. 0.15 mol of NaCl in one liter of H2O
3. 17.4 g of NaCl in two liters of the solution
4. 4.35 g of NaCl in 500 ml of H2O
5. 0.3 mmol of NaCl in two milliliters of the solution
6. 8.7 g of NaCl in one liter of the solution
7. 0.87 mg of NaCl in 100 ml of the solution
8. 150 mmol of NaCl in one dm3 of the solution

# The molar concentration *c*(A) of the compound A is:

1. determined by the proportion of the mass of the solute *m* (A) and the volume of the solution (*V*):



1. determined by the proportion of the amount of substance of solute *n*(A) and the solution

volume (*V*)

1. the number of moles of a substance A in 1,000 ml of a solvent
2. expressed by the formula: where *n*(A) = the amount of substance of the solute A, *V* = the volume of the solution



1. determined by the proportion of the amount of substance of the solute *n*(A) and the total amount of substance *n* of the solution
2. expressed by the formula: where *n*(A) = the amount of substance of the solute A, *n* = the total amount of substance of the system
3. the number of moles of the substance A in one dm3 of the solution
4. determined by the proportion of the amount of substance of the solute *n*(A) and the volume of the solvent

# In a saturated solution of a salt:

1. the same amount of the substance is dissolved in the time unit as it is again precipitated from the solution
2. its composition is the same under the defined conditions
3. the osmotic pressure is calculated according to the formula: where:



*c* = the concentration of the solution, R = gas constant, T = temperature in Kelvin

1. the maximum amount of the salt is dissolved under the defined conditions
2. there is the dynamic balance between the undissolved part of the substance and the solution
3. the equilibrium state is attained when during a time unit such a mass of the substance is dissolved which is equal to the mass of the substance already dissolved in the solution
4. the concentration is always 1 mol.l-1
5. the concentration is always 10 % (*w %*)

# Mixing equation:

1. can be expressed by the formula:
2. can be used to calculate the pH of buffers after their preparation from two basic solutions
3. can be expressed by the formula: *m*1*w*1 + *m*2*w*2 = *m*3*w*3, where: *m*1 and *m*2 are masses of solutions before their mixing, *m*3 is the mass of the resulting solution, and the symbol *w* denotes the mass fractions of the respective solutions
4. is used to calculate the values of the ionizing constants of the amino acid
5. is used to calculate the composition of the resulting solution after mixing two solutions of different concentrations
6. can be expressed by the formula: where *n*(A) = the amount of substance of the solute A, *V* = the volume of the solution



1. is used to calculate values of isoelectric points of neutral amino acids according to



the formula: 

1. can be expressed by the formula: *m*1(A) + *m*2(A) = *m*3(A), where *m*1 and *m*2 are masses of the solutions before their mixing, *m*3 is the mass of the resulting solution of the compound A

# Select the correct statement:

1. the amount of substance concentration c (A) is the number of moles of the substance A in one liter of a solution
2. the amount of substance concentration c (A) is the number of moles of the substance A in one dm3 of a solvent
3. the mass concentration of the substance A is determined by the fraction of the mass *m* (A) of the substance A and the volume of a solution *V*; the unit is kg.m-3 or kg.dm-3, g.l-1 may also be used
4. the mass fraction of the substance A is the number of grams of the substance A in 1,000 g of a solution
5. the volume fraction of the substance A is determined by the fraction of the volume *V* (A) of the substance A and the volume of a solution *V*
6. the volume fraction of the substance A is the number of milliliters of the substance A in 100 ml of H2O
7. when *w*(NaCl) = 0.13, the solution is composed of 13 g of NaCl + 100 g of H2O
8. the solution with the concentration *c* = 2 mol.l-1 contains two moles of a substance in two liters of a solution

# Osmosis:

1. is a process that cannot proceed in the human organism
2. is a property of a system consisting of a solvent, a solution and a semi-permeable membrane
3. occurs when two NaCl solutions of different concentrations are separated by a semipermeable membrane
4. is the spontaneous transition of particles of the substance from places with a higher concentration to places with a lower concentration
5. cannot occur when we add sterile distilled water to human blood
6. is the transition of solvent molecules through a semi-permeable membrane from a solution with a lower concentration of a substance to a solution with a higher concentration
7. is the same at the same concentration (mol.l-1) of both electrolyte and non-electrolyte solutions
8. is the opposite of the diffusion process

# Oxidation:

1. is any chemical reaction in which atoms of elements or their ions accept electrons
2. is any chemical reaction in which atoms of elements or their ions donate electrons
3. is a process associated with the decrease of the positive oxidation number of atoms
4. is a process associated with the elevation of the positive oxidation number of atoms
5. and reduction always occur together and are only the partial reactions of the oxidation - reduction reaction
6. in biological systems is the basis for metabolism
7. of the organic compounds is combined with their hydrogenation
8. is the process in which the molecule of the organic compound accepts two hydrogen atoms

# Reduction:

1. is any chemical reaction in which atoms of the elements or their ions accept electrons
2. is any chemical reaction in which atoms of the elements or their ions donate electrons
3. is associated with the decrease of the positive oxidation number of atoms
4. of silver by hydrogen is proceeding according to the reaction Ag2S + H2  2Ag + H2S
5. is the process in which the compound accepts two hydrogen protons
6. it is called dehydrogenation in organic compounds
7. it is also the combination of compounds with hydrogen
8. of organic compounds proceeds usually as the hydrogenation

# Oxidizing agents are substances:

1. which are proton acceptors in a chemical reaction
2. which are acceptors of hydrogen atoms in the dehydrogenation of substances
3. which accept electrons in the oxidation-reduction reaction
4. which are donors of electrons in a chemical reaction
5. which are reduced in the chemical reaction
6. to which we can include KMnO4, H2O2 and KClO3
7. which can oxidize other substances while being reduced
8. which can reduce other substances while being oxidized

# Dismutation is a reaction:

1. oxidation-reduction
2. in which one substance (molecules of the same compound, the same ions or atoms of the same element) can accept and donate electrons
3. in which the same ions or atoms of the same element undergo both oxidation and reduction
4. Cl2 + H2O HClO + HCl



1. 2 KMnO4 + 16 HCl 5 Cl2 + 2 MnCl2 + 2 KCl + 8 H2O
2. 3 K2MnO4 + 2 H2O 2 KMnO4 + MnO2 + 4 KOH
3. 3 HNO2 HNO3 + 2 NO + H2O

# The iodine atom has the oxidation number VII in the following compounds:

1. NaIO
2. I2O7
3. PbI2
4. NH4I
5. HIO3
6. KIO4
7. H3IO5
8. H5IO6

# The chromium atom has the oxidation number VI in the following compounds:

1. Cr2O3
2. KCr(SO4)212 H2O
3. Cr(OH)3
4. K2CrO4
5. K2Cr2O7
6. CrO3
7. CrCl3
8. PbCrO4

# The oxygen atom has the oxidation number -I in the following compounds:

1. Na2O2
2. BaO
3. K2O2
4. BaO2
5. Ba(OH)2
6. H2O2
7. H-O-O-H
8. H2O

# The manganese atom has the oxidation number VII in the following compounds:

1. MnSO4
2. Ca(MnO4)2
3. Mn2O7
4. KMnO4
5. K2MnO4
6. H2MnO3
7. MnS
8. CaMnO4

# The phosphorus atom has the oxidation number III in the compounds:

1. HPO3
2. Mg(H2PO4)2
3. Ca3(PO4)2.CaF2
4. Na2HPO4
5. H3PO3
6. P4O6

g)



h) PI3

# Which of the following statements is true for the chemical reaction Zn + CuSO4 ZnSO4 + Cu:

1. the copper cation is reduced
2. Cu2+ cation is an oxidant (oxidizing agent)
3. the reaction is oxidation-reduction
4. the oxidation numbers of the elements do not change
5. copper cation is oxidized
6. zinc is reduced
7. the reaction runs from left to right
8. zinc is a reducing agent, because in the electrochemical series of metals (Beckett serie) it stands in front of the copper

# Which of the following statements is true for the chemical reaction Fe + 2 HCl (diluted) FeCl2 + H2 :

1. Fe is oxidized
2. Fe is reduced
3. the reaction is oxidation-reduction
4. the chloride anion is oxidized
5. the reaction proceeds and Fe is a reducing agent
6. the reaction does not proceed
7. the H+ cation is an oxidizing agent
8. the H+ cation is reduced

# If we immerse pieces of iron and zinc in a solution of ferrous and zinc salts, the reaction proceeds:

1. Fe + Zn2+ Zn + Fe2+
2. Fe2+ + Zn Zn2+ + Fe
3. 2 Fe + 3 Zn2+ 2 Fe3+ + 3 Zn
4. the reduction of the iron cation by the action of metal zinc
5. in which elemental iron is oxidized
6. in which metal zinc is oxidized
7. oxidation-reduction
8. in which zinc metal acts as a reductant (reducing agent)

# For the oxidation-reduction reaction scheme, select the appropriate partial reactions or verify that the stoichiometric coefficients are correct:

**Cu + HNO3 Cu(NO3)2 + NO2 + H2O**

1. NV + 3 e NII
2. Cu0 + 2 e CuII
3. Cu0 - 2 e CuII
4. Cu0 - 1 e CuI
5. NIII + 1 e NII
6. NV + 1 e NIV
7. CuI - 1 e CuII
8. 1 + 4 1 + 2 + 2

# For the oxidation-reduction reaction scheme, select the appropriate partial reactions or verify that the stoichiometric coefficients are correct:

**H2O2 + KMnO4 + H2SO4 O2 + MnSO4 + K2SO4 + H2O**

1. MnVII + 5 e MnII
2. MnVI + 4 e MnII
3. SVI + 2 e SIV
4. 2 O-I - 2 e O20
5. MnVI - 4 e MnII
6. MnVII + 3 e MnIV
7. O-I + 1 e O-II
8. 5 + 2 + 3 5 + 2 + 1 + 8

# For the oxidation-reduction reaction scheme, select the appropriate partial reactions or verify that the stoichiometric coefficients are correct:

**H2O2 H2O + O2**

1. 2 HI - 2 e H20
2. 2 O-I + 2 e 2 O-II
3. 2 O-I - 2 e O20
4. 2 O-II - 4 e O20
5. 2 O-II - 2 e 2 O-I
6. 2 HI + 2 e H20
7. g) 2 2 + 1
8. 3 2 + 1

# For the oxidation-reduction reaction scheme, select the appropriate partial reactions or verify that the stoichiometric coefficients are correct:

**SO2 + H2S S + H2O**

1. S-II - 2 e S0
2. SII - 2 e S0
3. O-II - 1 e O-I
4. SIV + 4 e S0
5. SVI + 6 e S0
6. S-I - 1 e S0
7. H-I - 2 e HI
8. 1 + 2 3 + 2

# For the oxidation-reduction reaction scheme, select the appropriate partial reactions or verify that the stoichiometric coefficients are correct:

**Na2Cr2O7 + HCl NaCl + CrCl3+ Cl2+ H2O**

1. 2 Cl-I - 2 e Cl 0

2

1. 2 Cl-I - 2 e CrIII
2. CrVI + 3 e CrIII
3. ClI + 2 e Cl-I
4. NaII + 1 e NaI
5. CrVII + 4 e CrIII
6. O-I + 1 e O-II
7. 1 + 14 2 + 2 + 3 + 7

# Iodine is oxidized in reactions:

1. Cl2 + 2 KI I2 + 2 KCl
2. 2 KI + O3 + H2O I2 + 2 KOH + O2
3. 3 I2 + 10 HNO3 6 HIO3 + 10 NO + 2 H2O
4. NaIO3 + NaClO NaIO4 + NaCl
5. Pb(NO3)2 + 2 KI PbI2 + 2 KNO3
6. I2 + H2S 2 HI + S
7. I2 + 5 Cl2 + 6 H2O 2 HIO3 + 10 HCl
8. Na3AsO3 + I2 + H2O Na3AsO4 + 2 HI

# Sulfur is oxidized in reactions:

a) Fe2S3 + 4 HCl 2 FeCl2 + 2 H2 + 3 S

b) 2 Cr + 6 H2SO4 Cr2(SO4)3 + 3 SO2 + 6 H2O

1. I2 + H2S 2 HI + S
2. NaOH + SO2 NaHSO3
3. 2 FeCl3 + H2S 2 FeCl2 + S + 2 HCl
4. K2Cr2O7 + S Cr2O3 + K2SO4
5. Cl2 + SO2 + 2 H2O 2 HCl + H2SO4

h) 4 FeS2 + 11 O2 2 Fe2O3 + 8 SO2

# Select the reactions, in which H2O2 is the oxidizing agent:

1. H2O2 + 2 FeSO4 + H2SO4 Fe2(SO4)3 + 2 H2O
2. 5 H2O2 + 2 KMnO4 + 3 H2SO4 5 O2 + 2 MnSO4 + K2SO4 + 8 H2O
3. H2O2 + PbO2 + 2 HNO3 Pb(NO3)2 + O2 + 2 H2O
4. H2O2 + 2 KI + H2SO4 I2 + K2SO4 + 2 H2O
5. Mn2+ + H2O2 + 2 OH**-** MnO2 + 2 H2O
6. H2O2 + H2S 2 H2O + S
7. Ag2O + H2O2 2 Ag + H2O + O2
8. H2O2 + Fe2+ Fe3+ + OH**-** + •OH

# The rate of chemical reaction:

1. for gases depends on the pressure
2. depends on the concentration of reacting substances
3. is affected by the presence of catalysts
4. is directly proportional to the product of reactants´ molar concentrations
5. can be expressed as the change of reactants’ concentrations per a unit of time
6. does not depend on the value of activation energy
7. is determined by the equilibrium constant
8. depends on the temperature

# The equilibrium state of the reaction:

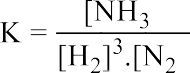
1. is the state in which the reaction proceeds by the same rate in both directions
2. is the state in which the reactants are completely converted to products
3. is expressed by the equilibrium constant
4. is the state in which concentrations of reactants in the reaction mixture are equal to concentrations of products
5. depends on the activation energy
6. can be affected by a change of temperature of the reaction mixture
7. can be affected by a change of products’ concentration
8. can be affected by the presence of catalysts

# Chemical equilibrium of the reaction 2 HBr H2 + Br2 with the reaction heat Qm = +70 kJ.mol-1 is shifted to the reactant side by:

1. increasing the temperature
2. decreasing the temperature
3. removing H2 from the reaction mixture
4. the addition of Br2 into the reaction mixture
5. the addition of a catalyst
6. the addition of HBr into the reaction mixture
7. removing HBr from the reaction mixture
8. the addition of H2 into the reaction mixture

# Select the correct expression for the equilibrium constant of the reaction N2 + 3 H2 2 NH3:

a)



b)



c)

d) K = [N2] . [H2]3

e)



f)

g)



h)



# Which of the following equations express exothermic process:

a) 2 SO3 2 SO2 + O2; Qm = +195 kJ.mol-1

b) CO + 1/2 O2 CO2; Qm = -283 kJ.mol-1

c) 4 NH3 + 5 O2 4 NO + 6 H2O; Qm = -906 kJ.mol-1

d) N2 + 3 H2 2 NH3; Qm = -93 kJ.mol-1

e) 2 H2 + O2 2 H2O; Qm = -452 kJ.mol-1

f) 2 H2O 2 H2 + O2; Qm = + 452 kJ.mol-1

g) C + O2 CO2; Qm = -394 kJ.mol-1

h) CH4 + 2 O2 CO2 + 2 H2O; Qm = -804 kJ.mol-1

# The activation energy of the reaction:

1. applies only during exothermic chemical processes
2. applies during both the exothermic and endothermic chemical processes
3. is related to the rate of the chemical reaction
4. is affected by the presence of a catalyst
5. is expressed by the equilibrium constant
6. is expressed by the reaction heat
7. depends on the reaction heat
8. depends on the equilibrium constant

# For the reaction 2 NO2 N2O4; Qm = -57 kJ.mol-1 the following statement applies:

1. when increasing the temperature, the equilibrium state of the reaction shifts toward the reactant side
2. the reaction is endothermic in the direction of N2O4 formation
3. when increasing the temperature, the equilibrium state of the reaction shifts to the product side
4. the reaction is exothermic in the direction of N2O4 formation
5. the reaction represents the oxidation-reduction process
6. when decreasing the temperature, the equilibrium state of reaction shifts toward the reactant side
7. when increasing the pressure (reaction in the gas phase), the equilibrium state of reaction shifts toward the product side
8. when decreasing the pressure (reaction in the gas phase), the equilibrium state of reaction shifts toward the product side

# According to Hess’s law, the value of reaction heat Qm of a given reaction:

1. depends on the way how the reaction proceeds
2. depends on the number of intermediate steps in which the reaction proceeds
3. is decreasing with an increasing number of intermediate steps
4. is determined by the difference between potential energies of products and reactants
5. is proportional to the reaction rate
6. is affected by the presence of a catalyst
7. depends on the equilibrium constant of the reaction
8. is increasing with an increasing number of intermediate steps

# For the exothermic reactions following statements apply:

1. the reaction system absorbs heat
2. the reaction system releases heat
3. potential energy of products is lower than that of reactants
4. they are the source of energy
5. they cannot have the character of redox processes
6. they cannot have the character of protolytic processes
7. they have the character of only redox processes
8. they cannot proceed in the living systems

# For the endothermic reactions following statements apply:

1. the reaction system absorbs heat
2. the reaction system releases heat
3. the potential energy of products is higher than that of reactants
4. they are the source of energy
5. all of them have the character of redox processes
6. all of them have the character of protolytic reactions
7. their Qm value has a positive sign
8. their Qm value has a negative sign

# The energy balance of the chemical reaction provides information:

1. about the difference between molar binding energies of formed as well as broken bonds
2. only about the value of molar binding energies of reactants
3. only about the value of molar binding energies of products
4. about the value of reaction heat Qm
5. about the value of the rate constant
6. about the value of activation energy
7. whether the given reaction is exothermic or endothermic
8. about the type or mechanism of the reaction

# Molecular hydrogen is more reactive than molecular nitrogen, since:

1. during the formation of H2 molecule from hydrogen atoms the lower amount of energy is released than during formation of N2 molecule
2. during the formation of N2 molecule from nitrogen atoms the higher amount of energy is released than during the formation of H2 molecule
3. binding energy in the N2 molecule is higher than in the H2 molecule
4. binding energy in the H2 molecule is lower than in the N2 molecule
5. reaction heat Qm of the H2 molecule formation from hydrogen atoms is lower than that of the formation of the N2 molecule
6. molecular hydrogen is less stable than molecular nitrogen
7. the boiling point of nitrogen is higher than that of hydrogen
8. H2 has lower relative molecular mass than N2

# The reaction heat Qm is the heat, which:

1. reaction systems release only in the chemical reaction
2. reaction systems exchange with the environment in the chemical reaction
3. is consumed or released in the chemical reactions
4. can have only a positive sign
5. value is influenced by the presence of a catalyst in the reaction mixture
6. value does not depend on the presence of a catalyst in the reaction mixture
7. expresses the rate of a chemical reaction
8. can have positive or negative signs in the chemical reactions

# Select the true statement about activation energy Ea:

1. the lower the activation energy, the higher the chemical reaction rate
2. its value is affected by the presence of a catalyst
3. its value is determined by the difference between the potential energy of the transition state complex of the reaction and potential energy of reaction products
4. the higher the activation energy, the lower the chemical reaction rate
5. it influences the value of the equilibrium constant of the reaction
6. it does not influence the rate of chemical reaction
7. it applies to both exothermic and endothermic reactions
8. it applies only to endothermic reactions

# The value of reaction heat Qm of a chemical reaction is determined by:

1. the presence of catalysts
2. the reaction rate
3. the value of the equilibrium constant
4. the value of activation energy
5. the difference between the relative atomic or molecular masses of reactants and products of a reaction
6. the amount of released or consumed energy in a reaction
7. the amount of energy which the reaction system exchanges with the environment
8. pH of the reaction medium

# Select the correct statement about the isotopes of hydrogen:

1. they have the same physical properties
2. they differ in the number of neutrons in their nucleus
3. they differ in the number of protons in their nucleus
4. they differ in the number of electrons in the electron shell
5. they have the same mass number
6. deuterium is the most abundant isotope of hydrogen occurring in organic compounds
7. they have the same atomic number
8. deuterium has the nucleus called deuteron, composed of one proton and one neutron

# Select the correct statement about hydrogen:

1. in the compounds with fluorine, oxygen and nitrogen the hydrogen atom can be bound with adjacent molecules by a covalent bond
2. hydrogen is the first member of the periodic table of elements
3. hydrogen cannot react with nitrogen directly and reaction N2 + 3 H2 2 NH3 does not proceed even at higher temperature or using the catalysts
4. hydrogen can also reduce sulfides, e.g. Ag2S + H2 2 Ag + H2S
5. hydrogen forms ternary (three elements containing) compounds - hydrides - with all elements of the periodic table
6. hydrogen atoms have the simplest electron configuration 1*s*1
7. hydrogen rapidly diffuses through the porous walls of solid substances
8. at low temperatures (-253 °C) hydrogen condenses to a colorless liquid

# A proton:

1. has strong reducing effects
2. can be an acceptor of an electron pair
3. is indicated as H+
4. forms the cation H3O+ with water
5. binds to cation H+ forming the hydrogen molecule
6. can provide the electron pair to other atoms
7. is unstable and combines with the compound possessing a free electron pair
8. is formed by removing the electron from the hydrogen atom

# Hydrogen atoms:

1. have very similar properties to those of other atoms in I.A group of the periodic table of elements
2. are more reactive than hydrogen molecules
3. can accept or donate electrons always leading to the formation of protons
4. acquire a more stable electron configuration by forming the chemical bond (e.g. in the molecule of H2)
5. are formed by the cleavage of the hydrogen molecule by supplying the necessary energy
6. are the cause of predominantly oxidative properties of hydrogen
7. are the cause of reducing properties of hydrogen (in most reactions)
8. are less reactive than the hydrogen molecules

# Select the reactions of binary compounds of hydrogen with water, which can proceed:

1. HBr + H2O H3O+ + Br-
2. KH + H2O H2 + KOH
3. CaH2 + 2 H2O 2 H2 + Ca(OH)2
4. PH3 + 4 H2O 4 H2 + H3PO4
5. BaH2 + 2 H2O 2 H2 + Ba(OH)2

f) C2H6 + 2 H2O 5 H2 + 2 CO2

1. AsH3 + 3 H2O H3AsO3 + 3 H2
2. NaH + H2O H2 + NaOH

# Deuterium:

1. has the nucleus composed of one proton and one neutron
2. has the nucleus composed of one proton and two neutrons like tritium
3. is the isotope of hydrogen
4. is the nuclide of light hydrogen
5. is designated D
6. can be used to monitor reaction mechanisms and kinetics
7. is the heavy water
8. forms deuterium oxide D2O with oxygen

# Choose the correct statement about the occurrence of hydrogen isotopes (protium, deuterium and tritium) in nature, mainly in water and organic compounds:

1. tritium occurs in the lowest amount
2. all three isotopes occur in the same ratio
3. deuterium occurs the most frequently in the heavy water
4. protium occurs in the lowest amount
5. deuterium and tritium are the most often occurring isotopes
6. the most frequently occurring isotope is free deuterium
7. protium occurs in the largest amount
8. the isotope  occurs the most frequently

# Hydrogen:

1. does not occur on Earth as atomic hydrogen under the normal conditions
2. can be prepared in the reaction of water steam with hot coal according to the following equation: C + H2O CO + H2
3. has very similar chemical properties to those of other elements in the group IA of the periodic table
4. can be prepared in the laboratory by water electrolysis
5. belongs to *s*2 elements
6. occurs in the universe in gaseous envelopes of Sun, fixed stars and nebulas
7. is the second lightest element in the periodic table after helium
8. can react with chlorine according to the following equation: H2 + Cl2 2 HCl

# H+ cation:

1. is also called protium
2. is formed from a hydrogen atom by losing an electron
3. forms the hydroxide ion in the reaction with water
4. forms the oxonium cation in reaction with water
5. is formed from a hydrogen atom by accepting an electron from the atom of another element
6. can bind to the proton to form an H2 molecule
7. can be a donor of an electron pair
8. is unstable and binds to the substance which possesses a free electron pair

# When an atom of oxygen accepts two electrons, there is formed:

1. an octet configuration of the previous noble gas helium
2. an anion O2-
3. an oxide anion O2-
4. an oxide cation O2+
5. peroxide O22-
6. an O2 molecule, which has two unpaired electrons
7. a univalent diatomic cation O2+
8. an atom of oxygen with the oxidation number -II

# Oxygen:

1. in the molecular form (O*2*) is more stable than atomic oxygen
2. dissolved in water is important for the life of water animals
3. is a colorless gas under the normal conditions
4. forms oxonium cations with water
5. can be prepared by decomposition of H2O2 after the catalytic effect of MnO2
6. in the molecular form (O2) is formed from two atoms of oxygen to gain a more stable electron configuration (of neon)
7. in the molecular form (O2) is more stable than ozone
8. cannot be prepared by the thermal decomposition of KMnO4

# Ozone:

1. is an isotope of oxygen
2. is formed from the molecule and the atom of oxygen and its formula is O3
3. is formed in the atmosphere during the storms
4. is prepared by fraction distillation of liquefied air
5. is formed in the following reaction: O + O2 O3
6. has reduction properties
7. easily releases atomic oxygen; therefore, it has oxidative effects
8. has the same molar mass as the molecular oxygen O2pj

# An atom of oxygen:

1. in compounds acquires an octet configuration of the next noble gas (Ne)
2. is stable at room temperature
3. in the reaction with another oxygen atom acquires more stable electron configuration of the previous noble gas
4. in compounds can form two single bonds or one double bond
5. has two unpaired electrons in the valence shell
6. can form longer chains similarly to a carbon atom
7. in compounds is mostly bivalent
8. after accepting two electrons forms an anion with an oxidation number -II

# Oxidation of substances by oxygen:

1. can proceed by the chain mechanism
2. does not change the oxidation number of the oxygen atom
3. mostly belongs to endothermic reactions
4. proceeds faster at temperatures up to 5 °C
5. e.g. in the reaction 4 Li + O2 2 Li2O leads to the change of oxidation number of an oxygen atom from 0 to -I
6. is, e.g. the reaction 2 H2 + O2 2 H2O
7. during which thermal and light radiations arise, is called burning
8. can also proceed in the water environment

# Select the correct statement about water:

1. water is the most quantitatively represented compound in the newborn body
2. mineral water is a chemical individual (entity)
3. water has the same crystal structure in all states
4. water is the solvent for ionic compounds
5. during the change of liquid water to ice the regular spatial structure is formed
6. water is a good solvent for non-polar compounds
7. water occurring in nature is a chemically pure substance
8. water can be a ligand in coordination compounds

# Individual atoms in water molecule:

1. do not contain free electron pairs at all
2. are not located in the straight line, but they form an angle of 104.5° (in the liquid state)
3. are bound by the covalent bond
4. are bound by the hydrogen bond
5. are bound by the ionic bond, and therefore the water is a good solvent of both ionic and covalent compounds
6. are bound by van der Waals forces
7. are located in the straight line
8. have the H-H-O structural arrangement

# At what temperature water has a maximum density:

a) 0 °C

b) 273.15 K

c) 4 °C

d) 373.15 K

e) 377.15 K

f) 0 K

g) 277.15 K

h) 100 °C

# The relatively high boiling point of water is caused by:

1. the fact that atoms of elements within a water molecule form bonds using their *s* and *p*

electrons

1. the fact that the bond between oxygen and hydrogen atoms is a coordinate bond
2. the fact that the bond between oxygen and hydrogen atoms is ionic
3. the fact that molecules of water in the liquid state are bound by hydrogen bonds
4. the fact that molecules of water are bound by oxygen bonds
5. the fact that oxygen and hydrogen atoms have the same electronegativity
6. the fact that energy is needed to split the H-O bond within a molecule of water
7. its relatively low molecular weight

# Which of the following statements about the hydrogen peroxide solution is true:

1. it can act as an oxidant in the following reaction: S2- + 4 H2O2 SO42- + 4 H2O
2. it can react with strong hydroxides producing salts such as hydrogen peroxides MIHO2 and peroxides M2IO2
3. it is used as a whitening agent and for disinfection in medicine (3 % water solution)
4. it is used for neutralization of weak acids
5. in the acidic environment it can reduce MnVII to MnII
6. concentration of hydrogen peroxide can be determined using the volume of oxygen that is released during the decomposition of hydrogen peroxide (catalyst MnO2)
7. it behaves as a weak base
8. its pH value is 7 - 9

# A molecule of hydrogen peroxide:

1. has the following arrangement of atoms: H-O-O-H
2. atoms of oxygen are bound together by a covalent bond
3. an atom of oxygen has the oxidation number -II
4. individual atoms within the molecule are bound with hydrogen bonds
5. an atom of oxygen has the oxidation number -I
6. has the following arrangement of atoms: O-H-H-O
7. atoms of hydrogen are bound together by a covalent bond
8. an atom of hydrogen has the oxidation number I

# Formulas of potassium hydrogen peroxide, strontium peroxide and sodium peroxide are:

1. KHO2, SrO2, Na(O2)2
2. K2O2, SrHO2, Na2O2
3. KO2, Sr(O2)2, NaHO2
4. KHO2, SrO2, Na2O2
5. KHO, Sr2O, NaHO2
6. K(O2)2, SrH(O2)2, Na2O2
7. (KH)2O2, Sr2O2, NaO2
8. K2HO, Sr2O, Na2O2

# Permanent hardness of water:

1. can be removed by boiling according to the reaction: CaCO3 + H2O + CO2 Ca(HCO3)2
2. is caused mainly by calcium sulfate and magnesium sulfate
3. can be removed according to the reaction: Ca(HSO4)2 CaSO4 + H2O + SO3
4. is caused mainly by CaSO4 and MgSO4
5. cannot be removed by boiling
6. can be removed by the addition of Na2CO3 while CaCO3 and MgCO3 are produced
7. can be removed by the addition of CaCO3
8. is caused mainly by CaCO3 and MgCO3

# Temporary hardness of water:

1. is caused by CaSO4 dissolved in mineral water
2. can be removed by the decomposition of salts which cause it, e.g. NaHCO3, according to the reaction: 2 NaHCO3 Na2CO3 + H2CO3
3. is caused by Ca(HCO3)2 and Mg(HCO3)2
4. cannot be removed by boiling
5. is caused mainly by magnesium bicarbonate and calcium bicarbonate
6. can be removed by boiling according to the reaction: Ca(HCO3)2 CaCO3 + H2O + CO2
7. is caused mainly by CaHPO4 and MgHPO4
8. is caused by bicarbonates of alkaline metals and alkaline earth metals

# *p* elements:

1. are for example noble gases (except He)
2. their atoms have two *s* electrons and one to six *p* electrons in their valence orbitals (except He)
3. are all elements located in the 4th, 5th and 6th period
4. are elements located in the groups IIIA - VIIIA of periodic table of elements (except He)
5. are transition elements
6. are elements located in the groups IIIB - VIIIB of the periodic table of elements
7. are for example Fe, Co, Ni
8. are elements located in the groups IA and IIA of the periodic table of elements

# Noble gases:

1. are the following elements: He, Ne, Ag, Kr, Xn, Rh
2. in their atoms the valence *s* and *p* orbitals (except He) are fully occupied resulting in an octet configuration
3. their valence *s* orbitals are occupied, and their valence *p* orbitals are gradually filled with one to six *p* electrons from He to Rn
4. in their valence shell they have two *s* electrons and eight *p* electrons (except He that has two *s* electrons only)
5. are elements of the group VIIIA of the periodic table of elements
6. are the following elements: He, Ne, Ar, Kr, Xe, Rn
7. their valence orbitals are incompletely occupied
8. are reactive elements

# At room temperature the elements of group VIIIA:

1. are present in small amounts in the atmosphere
2. are very stable
3. are liquids
4. are present as single unbound atoms
5. have electron configuration *s*2*p*6 in their valence shell (except He)
6. are present as two-atom molecules
7. are gases
8. are in solid state

# Halogen atoms can reach the electron configuration of the closest noble gas:

1. only by forming a molecule composed of two identical atoms (Br + Br Br2)
2. by forming a cation such as Cl3+, Br5+
3. by accepting one electron
4. by forming halide anion X- in ionic compounds
5. by the reaction with alkali metals
6. by donating one electron
7. in covalent compounds by forming one sigma and one π bond
8. by forming the anion X2- in ionic compounds

# Cl2O and Cl2O7 are anhydrides of the following acids:

|  |  |  |
| --- | --- | --- |
| a) HClO4 | and | HClO2 |
| b) HClO | and | HClO3 |
| c) HClO3 | and | HClO |
| d) HClO | and | HClO4 |
| e) chlorous | and | hypochlorous |
| f) hypochlorous | and | perchloric |
| g) chloric | and | chlorous |
| h) perchloric | and | chloric |

# **A halogen with higher electronegativity:**

1. is more able to form halide ion X- than halogen with lower electronegativity
2. can react with a halogen with lower electronegativity according to the reaction: F2 + 2 NaBr 2 NaF + Br2
3. causes dismutation of a halogen molecule with lower electronegativity
4. has a more polar bond in a compound with hydrogen (H-X) than a halogen with lower electronegativity
5. does not react with a halogen with lower electronegativity
6. causes the disproportionation of a halogen molecule with lower electronegativity
7. reduces a halogen with lower electronegativity
8. oxidizes a halogen with lower electronegativity

# Which of the following statements about halogens is true:

1. to reach the configuration of the closest noble gas they need one more electron
2. combining halogens with organic substances is called halogenation
3. iodine is able to sublime
4. bromine is able to sublime
5. iodine is a liquid at room temperature
6. they are quite reactive in chemical reactions
7. bromine is a liquid at room temperature
8. iodine is solid at room temperature

# Iodine tincture is:

1. 5 % (*w* %) solution of iodine in methanol
2. 5 % (*w* %) solution of iodine in ethanol
3. 5 % (*w* %) solution of iodine in diethyl ether and is used to clean wound surroundings
4. 3 % (*w* %) solution of potassium iodide in water
5. a disinfectant used to clean wound surroundings
6. 5 % (*w* %) solution of iodine in C2H5OH
7. 3 % (*w* %) solution of KI in ethanol
8. 5 % (*w* %) solution of iodine in chloroform

# Select the formula or name of a salt that is produced when chlorine oxoacid with oxidation number of a chlorine atom VII reacts with a ferrous hydroxide:

1. Fe(ClO4)2
2. iron(III) perchlorate
3. Fe(ClO3)2
4. Fe(ClO2)3
5. iron(II) chlorate
6. Fe(ClO4)3
7. Fe(ClO3)3
8. iron(II) perchlorate

# Disinfectant chlorinated lime is a mixture of:

1. Ca(ClO)2 + Ca(ClO2)2
2. sodium chlorate and calcium hypochlorite
3. CaCl2 a Ca(ClO)2
4. sodium hypochlorite and calcium chlorate
5. calcium hypochlorite and calcium chloride
6. sodium chloride and sodium hypochlorite
7. magnesium chloride and calcium chloride
8. calcium chlorate and calcium hypochlorite

# Which of the following statements about electronegativity of halogens is true:

1. iodine has higher electronegativity than bromine
2. fluorine has the highest electronegativity
3. all halogens have the same electronegativity
4. bromine has a higher electronegativity than chlorine
5. electronegativity decreases from fluorine to iodine
6. chlorine has a higher electronegativity than iodine
7. electronegativity increases from fluorine to iodine
8. a halogen with higher electronegativity can oxidize a halogen with lower electronegativity

# Chalcogens are:

1. elements of the group VIA of the periodic table of elements
2. elements of period 6 of the periodic table of elements
3. elements that have the following electron configuration in the valence shell: n*s*2n*p*6
4. the following elements: O, S, Se, Te, Po
5. elements with four *p* electrons in the valence shell
6. elements with six electrons in the valence shell
7. elements *p*5
8. elements that need two more electrons to reach the electron configuration of the closest noble gas

# Which of the following statements about sulfur is true:

1. it does not belong to biogenic elements
2. it exists in different structural modifications (so called allotropy)
3. it is present in nucleic acids
4. a sulfur atom has six electrons in the valence shell, and its highest positive oxidation number is six
5. sulfur is soluble very well in CS2
6. it is used to produce compounds used against plant pests
7. it is not present in amino acids at all
8. crystalline sulfur is insoluble in water

# Sulfur dioxide:

1. has both oxidative and reductive effects
2. sulfur and oxygen atoms are bound by an ionic bond
3. has oxidative properties only
4. can be directly oxidized into SO3
5. its formula is SO2
6. is industrially produced by combustion of sulfur in the air
7. can be dissolved in water forming H2SO3
8. is a gas that is an unwanted component of the atmosphere

# Select the formula or name of a salt that is produced when sulfur oxoacid with an oxidation number of sulfur atom VI reacts with a ferrous hydroxide:

1. FeSO3
2. Fe2S3
3. FeSO4
4. Fe2(SO4)3
5. iron(II) sulfite
6. iron(II) sulfate
7. iron(III) sulfate
8. iron(II) sulfide

# Chrome alum has the following formula:

1. KCr(SO3)2·12 H2O
2. K2Cr(SO3)2·12 H2O
3. KCr(SO4)2·12 H2O
4. K2SO3 - CrSO4·12 H2O
5. KCrS2O7·12 H2O
6. KCr(S2O4)2·12 H2O

g) K[Cr(SO3)4]·12 H2O

h) K2S2O4 - CrS2O6·12 H2O

# Which of the following statements about the sulfuric acid is true:

1. dissolving of H2SO4 in water produces a great amount of heat
2. it mixes with water in any ratio
3. in a diluted solution it loses its acidic properties and gains oxidative properties
4. it is formed by the reaction of SO3 with water
5. it forms salts called bisulfates and sulfates
6. it is produced by the reaction: SO2 + H2O H2SO4
7. when diluting the acid, we should add water into H2SO4
8. concentrated sulfuric acid has strong oxidative and dehydration effects

# The electron configuration of the valence shell of chalcogen atoms is:

1. such that they need to gain two electrons to reach the electron configuration of the nearest noble gas
2. n*s*2n*p*3
3. n*s*2n*p*4
4. n*s*2n*p*2
5. n*s*1n*p*5
6. n*s*1n*p*4
7. the same as the valence shell of halogens
8. n*s*2n*px*2n*py*1n*pz*1

# The electron configuration of a nitrogen atom (Z = 7) is:

1. [Ne]2*s*22*p*3
2. [He]2*s*22*px*12*py*12*pz*1
3. the same as in a phosphorus atom (Z = 15)
4. 1*s*22*s*22*p*3
5. [He]3*s*23*p*3
6. the same as in an arsenic atom
7. such that a nitrogen atom has three unpaired electrons
8. [He]2*s*22*p*3

# Elements of the group VA of the periodic table of elements:

1. belong to *p*3 elements
2. nitrogen and phosphorus belong to the basic biogenic elements
3. have five electrons in their valence shell
4. are: N, P, V, Nb, Ta
5. have their electrons in the shells K, L and M
6. have the following electron configuration in their valence shell: n*s*2n*p*3
7. all of them are found in nature in compounds only
8. are: nitrogen, phosphorus, arsenic, antimony and bismuth

# Molecules of nitrogen:

1. are very stable because the energy of N≡N bond is very high (946 kJ.mol-1)
2. contain atoms of nitrogen bound by polar covalent bonds
3. have the following electron formula: |N=N|
4. are present in the atmosphere at approx. 78 % (vol.)
5. are in a gaseous state at room temperature
6. are present in the atmosphere at approx. 21 % (vol.)
7. have two atoms of nitrogen bound by a triple bond
8. are unstable and decompose into single atoms

# Which of the following statements about ammonia is true:

1. it is a component of ammine complexes
2. it is a colorless gas at room temperature
3. it is insoluble in water
4. it behaves mostly as an acid because it donates a proton to other substances
5. its molecules can be bound together by hydrogen bonds
6. it can be formed by the reaction of nitrogen with hydrogen
7. it reacts with water as a Brönsted base
8. its water solution is colored by Congo red into blue-purple color

# Nitric acid:

1. can oxidize almost all metals except gold and platinum metals
2. forms salts such as binitrates (hydrogen nitrates) and nitrates
3. has strong oxidative effects that depend on its concentration, temperature and the type of oxidized substance
4. is a strong acid
5. it mixes with water in every ratio
6. forms salts with the general formula: MINO2
7. can be prepared in a laboratory by the following reaction: 2 NaNO3 + H2SO4 2 HNO3 + Na2SO4
8. with HCl in the ratio 1:3 forms aqua regia

# Which of the following statements about ammonium salts is true:

1. the cation NH4+ has acidic properties
2. ammonium carbonate is unstable and can decompose at about 60 °C
3. they can be composed of the cation NH4+ and acid anion X- and have a general formula NH4X
4. ammonium salts soluble in water can hydrolyze
5. almost all of them are well soluble in water
6. they do not ionize in water solutions
7. the basic character of the cation NH4+ is expressed by the protolytic reaction: NH4+ + H2O NH3 + H3O+
8. if their anion X- is derived from a strong acid, pH of their water solution is less than 7

# Which statement about phosphorus (Z = 15) is true:

1. with hydrogen it forms phosphane PH3 and diphosphane P2H4
2. it occurs in bones and teeth in the form of calcium and magnesium salts
3. with halogens (X) it forms compounds of types P2X3 and P2X5
4. it belongs to biogenic elements
5. its electrons are distributed in the shells K, L, M and N
6. it forms mostly ionic compounds
7. it forms mostly compounds with covalent bonds
8. with oxygen it forms oxides P4O6 and P4O10

# Which statement about nitrogen is true:

1. a nitrogen atom has a positive oxidation number only in the compounds with oxygen and fluorine which have a higher electronegativity
2. it is produced by the fractional distillation of liquefied air
3. in the atmosphere it occurs predominantly in the form of atomic nitrogen
4. it is used for the creation of an inert atmosphere
5. in some compounds a nitrogen atom can bind to other molecules also by hydrogen bonds
6. its molecule has the electron structural formula
7. it is present in the fertilizer called superphosphate
8. if a nitrogen atom in a compound has a lone electron pair, it can bind to atoms of other elements with coordinate bonds thus forming complexes

# Which statement about phosphorus is true:

1. it occurs in several allotropic modifications
2. with hydrogen it forms phosphane PH3 and diphosphane P2H4
3. it has three unpaired electrons in 3*p* orbitals
4. it has a 32P isotope, which is used in the study of reaction mechanisms
5. it occurs as white, red and black phosphorus
6. the mineral dolomite is a natural raw material for the production of phosphorus
7. it is a part of glycolipids
8. the phosphorus atom can bind to other molecules also by an oxygen bond

# Phosphoric acid:

1. is not present in the compounds: ATP, ADP and AMP
2. is formed by the reaction: P4O10 + 6 H2O 4 H3PO4
3. is important in the metabolism of carbohydrates
4. forms salts which all are well soluble in water
5. is a part of nucleic acids
6. is a tribasic, moderately strong acid
7. is very reactive and has strong oxidizing effects already at room temperature
8. forms only two types of salts: hydrogenphosphates and phosphates

# When 1 mol of trihydrogen phosphoric acid reacts with 1 mol of ferrous hydroxide, the product is:

1. Fe3(PO4)2
2. FeHPO4
3. Fe2(HPO4)3
4. Fe(H2PO4)2
5. ferrous dihydrogenphosphate
6. FePO4
7. ferric hydrogenphosphate
8. ferrous hydrogenphosphate

# Bismuth(III) perchlorate, strontium dihydrogenphosphate and ammonium dihydrogenarsenate have formulas:

|  |  |  |
| --- | --- | --- |
| a) Bi(ClO2)2, | SrHPO4, | (NH4)3AsO4 |
| b) Bi(ClO3)3, | Sr3(PO4)2, | NH4AsO3 |
| c) Bi(ClO4)3, | Sr(H2PO4)2, | NH4H2AsO4 |

|  |  |  |
| --- | --- | --- |
| 1. BiClO4, 2. BiCl3, 3. Bi(ClO)4, | SrH2P2O7, Sr3(PO4)2,  Sr(H2PO4)2, | (NH4)2AsO2 (NH4)3AsO3  NH4H2AsO4 |
| g) Bi(ClO)3, | Sr2P2O7, | (NH4)3AsO3 |
| h) Bi(ClO4)3, | Sr(H2PO4)2, | (NH4)2H2AsO4 |

# Which statement about carbon (Z = 6) is true:

1. a carbon atom cannot form compounds with different halogen atoms bound to the same carbon atom, e.g. CF2Cl2, CFCl3
2. a carbon atom can have an oxidation number -IV in compounds containing elements with a lower electronegativity (e.g. with hydrogen in methane)
3. it is the most widespread element in nature
4. in nature it is found in a pure form as well as bound in compounds
5. it belongs to biogenic elements
6. a carbon atom is found in compounds HCN, CS2 and COCl2 which are used as drugs in medicine
7. a carbon atom is tetravalent in most compounds
8. it belongs to *p*2 elements

# The compound COCl2:

1. is prepared by the direct combination of carbon monoxide with chlorine
2. is called guanidine
3. is dichloride of carbon monoxide
4. is called phosgene
5. is used as a solvent in laboratories
6. is a highly poisonous gas and it was used for military purposes
7. is a derivative of carbonic acid
8. has a structure: Cl-C-O-Cl and it is a derivative of hypochlorous acid

# Which statement about CO is true:

1. it can bind to transition metal atoms as a ligand
2. it is formed during the combustion of carbon under the insufficient air access
3. it is part of the exhaust gases of combustion engines, and it pollutes the environment
4. it has a structural formula: O=C=O and its molecule is symmetrical, nonpolar
5. it can be formed by the following reaction: C + CO2 2 CO
6. it is a component of water gas (the mixture of CO + H2)
7. it can oxidize metal oxides to elementary metals
8. it is formed by the thermal decomposition of CaCO3

# Which statement about carbon (Z = 6) is true:

1. the electron configuration of the carbon atom in the ground state is 1*s*22*s*22*p*x12*p*y1
2. a carbon atom in the ground state has two unpaired electrons in orbitals 2*p*
3. in compounds, its atom can have hybridization SP3
4. in most compounds it is divalent
5. energy of bonds C-C, C=C, C≡C is the same
6. a carbon atom can form polar and non-polar covalent bonds with atoms of other elements
7. for a carbon atom it is typical that in a compound it can bind with an atom of another element with a hydrogen bond
8. if the carbon atom in a compound has a lone pair, it can act as an electron donor and bind by a coordinate bond (e.g. transition metal carbonyls)

# Carbonic acid:

1. can be isolated from the solution in a crystal form
2. forms salts in which anions are HCO3- or CO32-
3. is also present in the human body
4. forms carbonate salts that cannot be decomposed by stronger acids than H2CO3
5. is formed by the dissolution of CO2 in water and predominant parts of the solution are hydrated molecules CO2· *x* H2O (where *x* = number of H2O molecules)
6. forms carbonate salts which undergo hydrolysis in an aqueous solution (if they are soluble)
7. forms an anion HCO3- which can be a base in some protolytic reactions
8. belongs to strong acids

# Which statement about elements of the group IVA of the periodic table of elements is true:

1. in nature they are found only in compounds (except carbon)
2. they have four electrons in the valence shell
3. C is non-metal, Si, Ge, Sn and Pb are metals
4. atoms of carbon, silicon and germanium are bound by double and triple bonds in compounds
5. they have the electron configuration in the valence shell: n*s*2n*p*2
6. they form the same compounds with very similar properties
7. they belong to biogenic microelements
8. their atoms need to gain four electrons to reach the electron configuration of the following noble gas

# Elements B, Al, Ga, In, Tl:

1. their atoms have the electron configuration n*s*2n*p*1 in the valence shell
2. belong to transition elements
3. occur in nature only bound in compounds
4. all of them form compounds in which their atoms are bound with covalent bonds only
5. have the same chemical reactivity and ability to form cations in aqueous solutions
6. belong to *p*1 elements
7. have three electrons in *p* orbital in the valence shell
8. are all metals except boron

# What is formed by the reaction of 3 moles of sulfuric acid and 2 moles of aluminium hydroxide:

1. 3 mol H2O
2. 1 mol aluminium sulfate
3. 1 mol Al2(SO3)3
4. 2 mol Al2(SO4)3
5. 6 mol H2O
6. 1 mol Al2(SO4)3
7. 2 mol aluminium sulfate
8. 1 mol aluminium thiosulfate

# Aluminium:

1. has a great reducing ability
2. does not conduct the electric current
3. forms salts with weak acids and these salts do not ionize in solutions and do not hydrolyze (e.g. acetate)
4. in compounds has atoms with the oxidation number III
5. is stable in the air because it is covered by a compact layer of oxide on its surface protecting it against the further effect of water and the environment
6. belongs to noble metals
7. does not form binary compounds
8. forms aluminium hydroxide which can react with water solutions of strong acids and hydroxides

# Elements: Li, Na, K, Rb, Cs, Fr:

1. have atoms which have one valence electron less than the previous noble gas
2. are also called alkaline earth metals
3. are metals
4. belong to *s*1 elements
5. are also called alkali metals
6. have one valence *p* electron
7. are in the group IA of the periodic table of elements
8. belong to elements with a high electronegativity

# Which of the statements about alkali metals is true:

1. cations of alkali metals M+ have the electron configuration of the previous noble gas
2. they are relatively soft and can be cut with a knife
3. their atoms are readily reduced to ions according to the general equation: M + e M-
4. their atoms have the oxidation number I in compounds
5. their atoms are oxidized to ions according to the general equation: M M2+ + 2 e
6. their atoms occur as anions in compounds
7. all isotopes of francium are radioactive
8. their oxides are base forming

# Elements *s*2:

1. form compounds in which their atoms have an oxidation number II
2. are also called alkali metals
3. belong to elements with a low electronegativity
4. are found in a pure form or bound in compounds in nature
5. are more reactive than the elements located in the group IIB of the periodic table of elements
6. are strong oxidizing agents
7. have atoms which can be oxidized according to the general equation: M M2+ + 2 e
8. form compounds which are all soluble in water

# Which statement about *s* elements is true:

1. all of them belong to metals (except hydrogen and He)
2. atoms of *s*1 elements have the oxidation number I in compounds
3. in compounds their atoms occur as anions
4. their atoms have one or two electrons more than the atoms of previous noble gases
5. atoms of *s*2 elements have typically the oxidation number II in compounds
6. their atoms have one or two electrons less than the atoms of previous noble gases
7. they are in the groups IA and IIA of the periodic table of elements (except He)
8. their atoms provide an electron pair for binding to other elements

# Magnesium:

1. belongs to non-metal elements
2. belongs to chalcogens
3. can be prepared by electrolysis of the MgCl2 melt
4. can occur in green plants
5. belongs to elements of the period 3 of the periodic table of elements
6. belongs to alkali metals
7. belongs to elements which are strong reducing agents
8. is located in the group IIA of the periodic table of elements

# Calcium oxide:

1. is solid under the laboratory conditions
2. is also called “slaked lime”
3. reacts with water and pH of the resulting solution is higher than 7
4. is used as a fertilizer and called “baryte”
5. can be prepared by the decomposition of CaCO3
6. is an acid-forming oxide
7. does not react with water
8. reacts with water thus forming a hydroxide

# s1 elements:

1. form salts which are mostly soluble in water (except hydrogen)
2. are: Be, Mg, Ca, Sr, Ba, Ra
3. they are characterized by good electrical and thermal conductivity (except H)
4. form cations which have one electron more than the previous noble gas
5. are located in the group IA of the periodic table of elements
6. due to their reactivity they are stored in the chemically inert environment (except H)
7. all of them form cations with the oxidation numbers I and II
8. form compounds which have a predominantly ionic character (except hydrogen)

# Which of the following statements about the alkalinity strength of hydroxide solutions formed from alkali metals and alkaline earth metals is true:

1. KOH is stronger than Ca(OH)2
2. CsOH is stronger than NaOH
3. LiOH is weaker than NaOH
4. KOH is weaker than LiOH
5. NaOH is weaker than RbOH
6. Ca(OH)2 is stronger than Ba(OH)2
7. Sr(OH)2 is stronger than CsOH
8. RbOH is stronger than Ca(OH)2

# Which statement about *d* elements is true:

1. they have high melting and boiling points (except Hg)
2. they can be ligands in coordination compounds
3. they have a good electrical and thermal conductivity
4. according to the oxidation number, their compounds have different colors of solutions, e.g.

Cr(VI) compounds are yellow and Cr(III) compounds are green

1. they are also called non-transitional elements
2. many of *d* elements and their compounds are catalysts of chemical reactions
3. they belong to alkaline earth metals
4. their atoms can have different oxidation numbers in compounds

# *d* elements are:

1. elements whose atoms have electrons in the orbital n*s* and also in orbitals (n - 1)*d*1-10, where: n = 4 - 7
2. transition elements
3. elements whose cations are in aqueous solutions mostly colorless
4. e.g. N, O, S, Cl
5. e.g. V, Cr, Mn, Zr, Mo
6. elements whose atoms can use n*s* as well as (n - 1)*d* orbitals for a bond formation
7. elements located in the group VIIIA of the periodic table of elements
8. elements located in the groups A of the periodic table of elements

# Select the neutral molecules or ions which can function as ligands in coordination compounds:

1. H2, Na+, CO32-
2. F-, Cl-, CN-
3. H2O, NH3, CO
4. all molecules or ions which can accept electrons
5. CN-, OH-, I-
6. Br-, H2O, CO

g) O22-, S2-, SCN-

h) O22-, H3O+, CH4

# In the coordination compound [Ni(NH3)6](NO3)2:

1. the cation [Ni(NH3)6]2+ is a ligand
2. molecules NH3 are ligands
3. anions NO3- are ligands
4. a nickel atom is a donor of an electron pair
5. nickel is the central atom
6. the oxidation number of the central atom is II
7. the central atom has the coordination number 6
8. the anion NO3- is bound to the central atom by a coordinate bond

# If the molecules H2O, NH3 and CO are ligands in coordination compounds, their names in formulas are:

|  |  |  |
| --- | --- | --- |
| a) aquo, | ammo, | carboxyl |
| b) hydro, | ammin, | carboxyl |
| c) aqua, | amino, | carbo |
| d) aqua, | ammine, | carbonyl |
| e) hydrato, | amo, | carbonate |
| f) hydro, | amino, | carbonate |
| g) aqua, | amo, | carbonato |
| h) hydro, | ammino, | carbonyl |

# The coordination number determines:

1. an oxidation number of a central atom of a complex
2. the group of the periodic table, into which a central atom of a complex belongs
3. the number of the period, into which a central atom of a complex belongs
4. the number of atoms directly bound by the coordinate bond to a central atom of a complex
5. whether the bond between the central atom of a complex and the ligand is simple, double or triple
6. the number of central atoms in a coordination compound
7. whether the central atom is directly linked to another central atom
8. the oxidation number of a complex cation

# In the coordination compound Na3[Sc(OH)6]:

1. the sodium atom is an acceptor of electrons
2. the coordination number of the central atom is 6
3. the Sc3+ cation is a ligand
4. OH- anions are ligands
5. a scandium atom is an acceptor of electrons
6. the oxidation number of a scandium atom is II
7. the central atom has the oxidation number III
8. an OH- anion represents the central atom

# Select the correct oxidation number of the central atom in following coordination compounds:

1. IV in (NH4)2[Ce(NO3)6]
2. II in K3[Co(CN)6]
3. III in [Fe(H2O)6]Cl2
4. IV in Cs2[Pt(OH)6]
5. II in [Pt(NH3)6]Cl4
6. I in K[Au(CN)2]
7. I in [Cu(H2O)4]SO4
8. II in K2[Ni(CN)4]

# Molecules containing a coordinate bond are:

1. bile acids and bile pigments
2. hemoglobin and vitamin B12
3. vitamin B12 and myoglobin
4. myoglobin and chlorophyll
5. vitamin A and bilirubin
6. vitamin D and riboflavin
7. chlorophyll and hemoglobin
8. purine bases and vitamin B6

# Select the true statement about the group VIIIB elements of the periodic table:

1. the eighth B group of the periodic table consists of three „triads“
2. the elements Fe, Co and Ni form the so-called iron triad
3. the elements Os, Ir and Pt (so-called platinum metals) are situated in the fourth period
4. for all their atoms the oxidation number VIII is typical
5. their atoms may have more oxidation numbers in compounds
6. the elements Os, Ir and Pt belong to noble metals
7. all platinum metals have low melting points, and they are relatively soft
8. rhodium and iridium may form alums, in which their atoms have the oxidation number III

# Select the true statement about coordination compounds:

1. the central atoms of complex compounds are mostly the elements of the group IA of the periodic table
2. the complex can be a cation, anion or a neutral
3. the central atom is the most often molecule, e.g. NH3, H2O, or an ion, e.g. Cl-, CN-
4. the central atom has a free electron pair (a lone pair)
5. the ligands are donors of electrons
6. the central atom and ligands are bound by the coordinate bond
7. the central atom and ligands are bound by the ionic bond
8. the central atom is an acceptor of electrons

# Select the true statement about copper and its compounds:

1. in the compound Na2[Cu(OH)4] the copper atom has the coordination number 2 and oxidation number I
2. the copper atom with the oxidation number II cannot be a central atom in the coordination compounds
3. cupric sulfate is part of Fehling reagent for proof of reducing properties of organic compounds (e.g. monosaccharides), according to the following reaction:

Cu2+ + e Cu+

1. copper and silver do not conduct electricity
2. many copper (II) compounds are water soluble to form blue solutions
3. the copper atoms in compounds have oxidation numbers I and II
4. the compound CuSO4·5H2O is also called blue vitriol
5. the compound Cu2S is called copper (II) sulfide

# Select the correct statement about elements of the group IIB and their compounds:

1. mercury compounds are not toxic to human organism; only metallic mercury is toxic
2. atoms of the group IIB elements, similarly to those of the group IIA, have eight electrons in the penultimate shell (*n*-1)
3. in compounds, mercury can have oxidation number I, e.g. in Hg2Cl2 (calomel), or II, e.g. in HgCl2 (sublimate)
4. atoms of the group IIB elements have their valence electrons in K, L, M and N shells
5. mercury can form an alloy with aluminum and iron, which is called alpaca
6. atoms of the group IIB elements have two *s* electrons in n*s* orbitals and 18 electrons in (*n*-1) shell
7. cadmium can react with hydrochloric acid according to the equation:

Cd + 2 HCl CdCl2 + H2

1. atoms of the group IIB elements have smaller atomic radii than those of the group IIA in the same period and are less reactive

# Select correct names of the following compounds [Fe(H2O)6]Cl2 and Cs2[Pt(OH)6]:

1. hexaaquairon(II) chloride, cesium hexaaquaplatinate(IV)
2. hexaaquairon(III) chloride, cesium hexaaquaplatinate(IV)
3. hexaaquairon(II) chloride, cesium hexahydroxidoplatinate(IV)
4. chlorine hexaaquairon(II), cerium hexahydroxidoplatinate(II)
5. hexaaquairon(III) chloride, cesium hexahydroxidoplatinate(IV)
6. hexaaquairon(II) chloride, cesium hexahydridoplatinate(II)
7. chlorine hexaaquairon(II), cesium hexahydroxidoplatinate(IV)
8. hexaaquairon(III) chloride, cesium hexahydridoplatinate(II)

# Select the correct statement about radioactivity:

1. external conditions cannot affect the type of nuclear radiation (α, ß or γ)
2. α, ß and γ rays do not differ in their behavior in electric and magnetic fields
3. it does not depend on whether the atom is a part of an element or a compound
4. radioactivity can also be characterized by half-life, the time in which the number of nuclei of radioactive atoms decreases to one half of their original number
5. it is an attribute of atomic nuclei
6. it is a spontaneous decay of atomic nuclei of some elements accompanied by the emission of nuclear radiation
7. natural radioactivity is an energy demanding process in which only an electron shell of an atom of a radioactive element is changed
8. the discovery of radioactivity confirmed that atomic nuclei are indivisible particles

# Which of the following statements about nuclear radiation is true:

1. by emitting an α particle a new atom of an element is formed with the mass number four units higher than the parent atom
2. ß radiation is a stream of electrons that can be halted by a lead plate with the thickness

of 1.5 mm

1. γ radiation is a form of electromagnetic radiation with a very short wavelength (0.5 - 40 pm)
2. γ radiation is the least penetrating type of nuclear radiation
3. α, ß and γ radiations differ in their behavior in electric and magnetic fields
4. by emitting an α particle a new atom of the element is formed with the atomic number two units less and the mass number four units less than the parent atom
5. α radiation is a stream of fast helium nuclei, and it is deflected by the magnetic field as a stream of positive charges
6. γ radiation has the same energy than the light radiation

# Which statement about radioactivity is true:

1. α radiation is caused by the nuclear transformation of an electron into a proton
2. spontaneous radioactive nuclei transformations are possible when the nuclear binding energy is released
3. by emitting an α particle, an element moves two positions to the left and by emitting ß

particle one position to the right in the periodic table of elements

1. ß radiation is a stream of fast protons
2. ß radiation is caused by the transformation of a neutron into a proton
3. ß rays are deflected by the magnetic field as a stream of negative charges
4. ß radiation is more penetrating compared to α radiation
5. γ radiation is associated with the formation of a new element that is placed in the periodic

table of elements two positions to the right of the parent element

# Cl- ions were precipitated as silver chloride from an examined solution of potassium chloride using silver nitrate. The mass of filtered and dried AgCl was **0.26 g. Calculate the content of Cl- in the examined sample. Ar(K) = 39; Ar(Cl) = 35.5; Ar(Ag) = 107.9**

1. 0.164 g
2. 180 mg
3. 64 mg
4. 18 mmol
5. 6.4×10-3 mol
6. 640 mg
7. 1.8×10-3 mol
8. 180 mmol

# 45 ml of gastric juice were collected from a patient during the stomach examination within 30 minutes by gastric tube. 5 ml of this juice was taken to the beaker, completed with distilled water to 20 ml volume and neutralized by addition of 4 ml **of sodium hydroxide solution with a concentration of *c* = 0.5 mol.l-1. What is the secretion of gastric juice? Mr(HCl) = 36.5**

1. 25 mmol of HCl/hour
2. 0.18 mol of HCl/hour
3. 0.036 g of HCl/hour
4. 0.036 mol of HCl/hour
5. 2.53 g of HCl/hour
6. 1.31 g of HCl/hour
7. 145 mmol of HCl/hour
8. 145 mg of HCl/hour

# What amount of water has to be evaporated from 600 g of 3.5 % (*w %*) sodium chloride solution to prepare 12 % (*w %*) NaCl solution? Mr (NaCl) = 58; **Mr(H2O) = 18**

1. 175 g
2. 28.3 mol
3. 3.5 mol
4. 350 g
5. 425 g
6. 23.6 mol
7. 480 g
8. 1.8 mol

# 25 liters of 80 % (*w %*) sulfuric acid (ρ = 1.70 kg.l-1) should be diluted to 16 % **solution. What volume of water (ρ = 1.0 kg.l-1) should be added?**

a) 1.7×104 cm3

1. 125 ml
2. 1.7×102 liter

d) 125×104 ml

e) 17×104 cm3

f) 0.27 hl

g) 1.25×103 dm3

h) 2.7×102 dm3

# Calculate the crystallization yield, if 900 g of potassium chloride solution saturated at 75 °C is cooled down to 0 °C. The solubility of potassium chloride at 75 °C is 50 g in 100 g of water and solubility at 0 °C is 26 g in 100 g of water.

a) 114.3 g

b) 125.0 g

c) 144.0 g

d) 168.0 g

e) 228.6 g

f) 254.0 g

g) 288.0 g

h) 328.0 g

# 210 g of water were evaporated from 500 g of a solution of barium chloride with the concentration *w* = 24 % resulting in precipitation of 40 g of barium chloride. **What is the % concentration (*w %*) of the resulting solution?**

a) 16 %

b) 20 %

c) 24 %

d) 26 %

e) 30 %

f) 32 %

g) 36 %

h) 39 %

# Calculate the amount of water in which 100 g of sodium carbonate decahydrate has to be dissolved to prepare a saturated solution at 20 °C. The solubility of sodium **carbonate at 20 °C is 18 g in 100 g of solution. Ar(H) = 1; Ar(C) = 12; Ar(O) = 16; Ar(Na) = 23**

a) 52.8 g

b) 76.9 g

c) 98.8 g

d) 105.9 g

e) 122.8 g

f) 134.6 g

g) 155.9 g

h) 64.6 g

# One nmol is:

1. 103 pmol
2. 109 mol
3. 10-6 mmol
4. 103 mmol
5. 10-9 mol
6. 106 fmol
7. 10-3 pmol
8. 10-3 µmol

# If we dissolve 35 g of NaNO3 in 250 g of water then:

1. we get 14 % (*w*/*w*) solution
2. we get 12.28 % (*w*/*w*) solution
3. we get 35 % (*w*/*w*) solution
4. 140 g NaNO3 is in 1 kg of solution
5. 12.28 mg NaNO3 is in 0.100 g solution
6. 24.56 g NaNO3 is in 250 g of solution
7. 14 g NaNO3 is in 1 l of water
8. 368.4 g NaNO3 is in 3 kg of solution

# A solution of KCl with the mass fraction *w*(KCl) = 0.03, contains:

1. 3 g KCl in 97 g of H2O
2. 3 g KCl in 1,000 ml of solution
3. 0.01 g KCl in 0.1 kg of solution
4. 0.003 g KCl in 10 g of solution
5. 6 g KCl in 0.2 kg of solution
6. 3 g KCl in 100 g of solution
7. 6 g KCl in 200 g of water
8. 6 g KCl in 200 ml of water

# How many mass percent of individual elements are present in thiourea? **Ar(N) = 14; Ar(H) = 1; Ar(C) = 12; Ar(O) = 16; Ar(S) = 32**

a) 20.10 % C

b) 36.84 % N

c) 36.66 % S

d) 15.79 % C

e) 42.11 % N

f) 5.26 % H

g) 26.66 % O

h) 42.11 % S

# To prepare 250 cm3 of a saturated silver iodate solution, 0.011 g of AgIO3 is used. Calculate the solubility constant (KS) of this salt. What are the concentrations of the ions in this solution? Mr(AgIO3) = 282

a) KS = 2.43×10-4

b) KS = 1.56×10-4

c) KS = 2.43×10-8

d) KS = 3.79×10-8

e) [Ag+] = 2.43 mmol.l-1

f) [Ag+] = 0.156 mmol.l-1

g) [IO3-] = 1.56×10-4 mol.l-1

h) [IO4-] = 1.56×10-4 mol.l-1

# The solubility constant of silver bromide is 3.6×10-13. How many grams of Ag+ and Br- are present in 1 liter of saturated solution of this salt? What are the concentrations of the ions in the solution? Ar(Ag) = 108; Ar(Br) = 80

a) *c*(Ag+) = 6.48×10-5 mol.l-1

b) *c*(Ag+) = 6×10-7 mol.l-1

1. 6.48×10-5 g of Ag+ in 1 liter of saturated solution
2. 6.48×10-5 g of Br- in 1 liter of saturated solution
3. 4.8×10-5 g Br- in 1 liter of saturated solution

f) *c*(Br-) = 6×10-4 mmol.l-1

g) *c*(Br-) = 6.48×10-5 mol.l-1

h) *c*(Ag+) = 3.6×10-13 mol.l-1

# A saturated aqueous solution of silver hydroxide was prepared by dissolving silver oxide in water. The pH of the solution after equilibration was 9.5. Calculate the solubility constant (KS) of silver hydroxide under given conditions. What are the concentrations of the ions in the solution? (antilogarithm -4.5 = 3.16×10-5)

a) KS = 3.16×10-10

b) KS = 6.32×10-10

c) KS = 9.99×10-12

d) KS = 9.99×10-10

e) *c*(Ag+) = 6.32×10-5 mol.l-1

f) *c*(Ag+) = 3.16×10-2 mmol.l-1

g) *c*(OH-) = 3.16×10-5 mol.l-1

h) *c*(OH-) = 3.16×10-2 mol.l-1

# Determine, if mixing the same volumes of a CaCl2 (*c* = 0.01 mol/l) solution and Na2SO4 (*c* = 0.01 mol/l) solution forms a CaSO4 precipitate. The solubility constant of CaSO4 is 2.3×10-4. What are the concentrations of the Ca2+ and SO42- ions in the mixture?

a) [Ca2+] = 0.01 mol.l-1

b) [Ca2+] = 10 mmol.l-1

1. CaSO4 precipitate is formed
2. CaSO4 precipitate is not formed

e) [Ca2+] = 5×10-3 mol.l-1

f) [SO42-] = 0.01 mol.l-1

g) [SO42-] = 0.05 mol.l-1

h) [SO42-] = 5 mmol.l-1

# To dissolve 1 g of lead iodide at 18°C is required to add water to a volume **of 1,470 ml (ρH2O = 1 g.cm-3). Calculate the concentration of PbI2 and ions in the solution and determine the solubility constant (KS) of lead iodide. Ar(I) = 127; Ar(Pb) = 207**

a) *c*(PbI2) = 2.169×10-3 mol.l-1

b) KS = 1.28×10-6

c) KS = 1.28×10-8

d) *c*(Pb2+) = 1.28×10-4 mol.l-1

e) *c*(Pb2+) = 1.476 mmol.l-1

f) *c*(PbI2) = 2.951×10-3 mol.l-1

g) KS = 2.28×10-6

h) *c*(I-) = 2.951 mmol.l-1

# The concentration of KMnO4 is 2×10-3 mol.l-1. Calculate the amount of substance of KMnO4 present in 250 ml solution:

a) 5×10-3 mol

b) 1×10-2 mol

c) 5×10-4 mol

d) 3×10-4 mol

1. 5 mmol
2. 0.5 mmol
3. 50 µmol
4. 500 µmol

# Calculate the amount of substance concentration of the hydrochloric acid in the solution at the density of 1.1 g.cm-3, where 18 % (*w %)* of HCl is present. **Mr(HCl) = 36.5**

a) 2.73 mol.l-1

b) 3 mol.l-1

c) 5.42 mol.l-1

d) 1.24 mol.l-1

e) 0.542 mol.l-1

f) 5.42×103 mmol.dm-3

g) 4.93 mol.l-1

h) 4.93 mmol.l-1

# Calculate what volume of ferric chloride solution at a concentration of **c = 0.2 mol.l-1 can be prepared by dissolving 48.6 g of iron (III) chloride in water. Mr(FeCl3) = 162**

1. 15 liters
2. 1.5 liter
3. 150 ml
4. 20 liters

e) 1.5×106 µl

f) 1,500 cm3

g) 2,000 cm3

h) 200 cm3

# Indicate the true statement about the solution of NaOH, c = 2 mol.l-1, **ρ = 1.08 g.cm-3. Mr(NaOH) = 40.**

a) *w* = 10.8 %

b) *w* = 8.00 %

c) *w* = 7.41 %

d) *w* = 1.08 %

e) 7.41 g of NaOH is dissolved in 100 g of the solution

f) *w* = 0.0741

1. 8.00 kg of NaOH is dissolved in 800 kg of the solution
2. the solution can be composed of 14.82 g of NaOH and 185.18 g of H2O

# Calculate the amount of sulfuric acid in 2,500 cm3 of the solution with the concentration of 0.6 mol.dm-3. Mr(H2SO4) = 98

1. 15 mol
2. 12 mol
3. 1.5 mol

d) 0.147 kg

e) 147 g

f) 14.7 g

1. 98 g
2. 1.5 liter

# Calculate either the concentration of HNO3 in the solution that contains 3.5×10-3 mol of HNO3 in 400 ml of the solution or the mass of HNO3 in 400 ml of the given solution. Mr(HNO3) = 63

a) 7.85 mol.l-1

b) 8.75×10-3 mol.l-1

c) 440 mg

d) 0.22 g

1. 7.85 mmol.l-1
2. 8.75 mmol.l-1
3. 220 mg

h) 0.55 g

# How much of sodium sulfate is needed to prepare 5 liters of 8 % (w %) solution, the density of which is 1.075 g.cm-3? Mr(Na2SO4) = 142

1. 43 g
2. 430 g
3. 400 g
4. 40 g

e) 0.3028 mol

1. 0.605 mol
2. 3.028 mol
3. 0.43 kg

# To 400 ml of the 85 % (*w* %) solution of sulfuric acid with a density of 1.8 g.cm-3 there was added 800 ml of water. What is the concentration of the H2SO4 original solution (co) and the diluted solution (*c*d)? Mr(H2SO4) = 98

1. *c*o = 13.6 mol.l-1
2. *c*o = 15.6 mol.l-1

c) *c*d = 5.2×103 mmol.l-1

1. *c*o = 1.56 mol.l-1
2. *c*d= 5.2 mol.l-1
3. *c*d = 5.2 mmol.l-1
4. *c*d = 4.5 mol.l-1

h) *c*o = 1.56×104 mmol.l-1

# What amounts of CuSO4·5H2O, or water are needed to prepare 1.5 kg of 6 % (*w* %) solution of CuSO4? Mr(CuSO4·5H2O) = 250; Mr(H2O) = 18

a) 90 g of blue vitriol

b) 1,359.4 g of H2O

1. 1,410 g of H2O
2. 1.3594 kg of H2O
3. 140.6 g of blue vitriol
4. 0.1406 kg of CuSO4·5H2O
5. 140.6 g of CuSO4
6. 90 g of CuSO4·5H2O

# Calculate the volumes of 95 % (v %) ethanol or water needed to prepare 600 ml of the solution in which 40 % (v %) of ethanol is present:

1. 360 ml of H2O
2. 240 ml of ethanol
3. 252.63 ml of ethanol
4. 347.37 ml of H2O
5. 0.34737 liter of ethanol
6. 0.34737 liter of H2O
7. 295.63 ml of H2O
8. 0.25263 liter of ethanol

# We have a solution A containing 18.9 g of HNO3 per liter and a solution B containing 3.2 g of NaOH in 1 liter. In what volume ratio do we have to mix them to produce a neutral solution? Mr(HNO3) = 63; Mr(NaOH) = 40

1. 1 liter of A + 37.5 liters of B
2. 3.75 liters of B + 1 liter of A
3. 5 liters of B + 15 liters of A
4. 18.75 liters of B + 5 liters of A
5. 4 liters of A + 15 liters of B
6. 10 ml of A + 37.5 ml of B
7. 0.6 ml of A + 2.25 ml of B
8. 0.8 ml of B + 3 ml of A

# Calculate how much water, or technical soda containing 95 % Na2CO3 is needed to prepare 350 g of 8 % (w %) Na2CO3 solution:

a) 29.47 g of technical soda

b) 29.47 g Na2CO3 10 H2O

1. 28 g of technical soda
2. 322.0 g of H2O
3. 320.53 g of H2O
4. 26.6 g of Na2CO3
5. 2.947×104 mg of technical soda
6. 0.32053 kg of H2O

# pOH of the completely dissociated nitric acid solution is 9.602. Calculate the pH or the concentration of the solution. (log 4 = 0.602; log 2.5 = 0.398)

a) pH = 10.602

b) *c* = 4×10-2 mmol.l-1

c) *c* = 2.5×10-1 nmol.l-1

d) pH = 4.398

e) *c* = 2.5×10-10 mol.l-1

f) *c* = 4×10-5 mol.l-1

g) pH = 5.398

h) *c* = 4.398×10-3 mol.l-1

# What is the pH, pOH, *c*(OH-) and *c*(H3O+) of KOH solution, 1 liter of which neutralizes 500ml of the HCl solution at the concentration 3 mmol.l-1? **(log 5 = 0.699; log 3 = 0.477; log 1.5 = 0.176; log 6 = 0.778)**

a) pH = 11.176

b) pOH = 1.222

c) pOH = 2.824

d) pH = 12.778

e) *c*(H3O+) = 1.5×10-12 mol.l-1

f) *c*(H3O+) = 6.67×10-12 mol.l-1

g) *c*(OH-) = 1.5×10-3 mol.l-1

h) *c*(OH-) = 6×10-3 mol.l-1

# Calculate the pH and pOH of the solution containing 0.33 g of HCl in 600 ml. What is the HCl solution concentration? Mr(HCl) = 36.5; (log 1.5 = 0.176)

a) pH = 12.176

b) pOH = 1.824

c) pH = 1.824

d) [HCl] = 1.5×10-2 mol.l-1

e) pOH = 10.92

f) pOH = 12.176

g) [HCl] = 1.25×10-2 mol.l-1

h) pOH = 2.08

# pH of the H2SO4 solution is 1.097. Calculate the concentration of the sulfuric acid solution (log 8 = 0.903; log 4 = 0.602; antilogarithm -1.097= 0.07998)

a) 80 mmol.l-1

b) 0.08 mol.l-1

c) 8.10-3 mol.l-1

d) 0.04 mol.l-1

1. 20 mmol.l-1
2. 40 mmol.l-1

g) 4.10-2 mmol.l-1

h) 12 mmol.l-1

# Calculate the pH or the pOH of a solution containing 0.17 g of hydroxyl ions in 5 liters. What are the H3O+ and OH- ions concentrations in this solution? **Mr(OH-) = 17. (log 5 = 0.699; log 1.7 = 0.230; log 2 = 0.301)**

a) pH = 11.301

b) pH = 10.699

c) *c*(OH-) = 2×10-3 mol.l-1

d) pOH = 2.301

e) pOH = 2.699

f) *c*(OH-) = 2×10-6 mol.l-1

g) *c*(H3O+) = 5 mmol.l-1

h) *c*(H3O+) = 5×10-6 µmol.l-1

# There are two solutions: solution A of pOH = 10 and solution B of pOH = 12. Indicate the true statement about these solutions:

1. solution A is more acidic than B solution
2. pH of B solution is lower than pH of the solution A
3. pH of the solution A is higher by 2 than pH of B solution
4. in the A solution the H3O+ concentration is 100-times higher than in the B solution
5. in the A solution is *c*(OH-) = 1×10-4 mol.l-1
6. in the B solution is *c*(OH-) = 1×10-2 mol.l-1
7. in the A solution is *c*(H3O+) = 1×10-4 mol.l-1
8. in the B solution is *c*(H3O+) = 10 mmol.l-1

# Calculate the amount of products formed during the reaction of 16.35 g of zinc with sulfuric acid. Ar(Zn) = 65.4; Ar(S) = 32; Ar(O) = 16; Ar(H) = 1

1. 1 mol of H2
2. 40.35 g of ZnSO4
3. 0.5 mol of ZnSO4
4. 0.25 mol of H2
5. 0.5 g of hydrogen
6. 32.7 g of ZnSO4
7. 250 mmol of ZnSO4
8. 500 mmol H2

# Calculate the amount of ammonia formed in its synthesis from nitrogen and hydrogen if the amount of hydrogen entering the reaction is 4.5 mol. Ar(N) = 14; **Ar(H) = 1**

a) 0.051 kg

1. 3.6 mol
2. 44.8 liters
3. 51 g
4. 34 g
5. 3 mol

g) 67.2 dm3

h) 4.5 mol

# The glucose solution, administered to a patient (with suspected diabetes) during the oral glucose tolerance test, contains 75 g of glucose in 250 ml of the solution. Calculate either the solution volume or the glucose quantity at this solution that must be **administered to a child of 20 kg weight after overnight fasting, if 1.75 g of glucose must be given per kg of body weight.**

1. 35 ml
2. 0.116 liter
3. 0.035 liter
4. 58.33 ml
5. 35 g of glucose
6. 116 g of glucose
7. 0.035 kg of glucose
8. 116.66 ml

# What products and in what quantities are produced by the thermal decomposition of 7.5 g of calcium carbonate? Ar(Ca) = 40; Ar(C) = 12; Ar(O) = 16

1. 5.6 g of CaO
2. 1.68 dm3 of CO2
3. 1.68 dm3 of CaO
4. 0.75 mol of CaO
5. 75 mmol of CO2
6. 4.2 g of CaO
7. 0.75 mol of CO2
8. 3.3 g of CO2

# Chlorine can be prepared by acting of sulfuric acid on sodium chloride in the presence of manganese dioxide. How much chlorine do we get from 0.0234 kg NaCl under the laboratory conditions? Ar(Na) = 23; Ar(Cl) = 35.5

a) 4,480 ml

1. 7.1 g
2. 0.2 mol
3. 4.48 liters

e) 14.2 g

1. 0.1 mol
2. 2.24 liters
3. 200 mmol

# Calculate either the amount of sulfur dioxide produced by burning 112 grams of sulfur or the amount of oxygen needed in the reaction. Ar(S) = 32; Ar(O) = 16:

1. 112 g of O2
2. 7 mol of O2
3. 78.4 dm3 of SO2
4. 3.5 mol of O2
5. 156.8 dm3 of O2
6. 156.8 liter of SO2
7. 112 g of SO2
8. 3.5 mol of SO2

# Calculate how much chlorine reacts with 0.5 mol of iron in the reaction of ferric chloride production or how much FeCl3 is produced? Ar(Fe) = 56; Ar(Cl) = 35.5

1. 16.8 dm3 of Cl2
2. 33.6 dm3 of Cl2
3. 0.5 mol of Cl2
4. 81.25 g of FeCl3
5. 40.62 g of FeCl3
6. 0.75 mol of Cl2
7. 53.25 g of Cl2
8. 0.5 mol of FeCl3

# Calculate the amount of zinc and sulfur needed to prepare 24.25 g of zinc sulfide. **Ar(Zn) = 65; Ar(S) = 32**

1. 0.25 mol of S
2. 0.50 mol of Zn
3. 16.25 g of Zn
4. 0.20 mol of Zn
5. 0.25 mol of Zn
6. 8 g of S
7. 0.20 mol of S
8. 8.12 g of Zn

# Calculate the amount of hydrogen and KOH produced in the reaction of 23.4 g of potassium with water. Ar(K) = 39; Ar(H) = 1; Ar(O) = 16

1. 0.6 g of H2
2. 6 g of H2
3. 0.3 mol of H2
4. 33.6 g of KOH
5. 0.3 mol of KOH
6. 600 mg of H2
7. 0.6 mol of KOH
8. 0.6 mol of H2

# 6 mol of NaOH was added to a solution containing 1.8 mol of FeCl3. How much of NaCl and Fe(OH)3 were formed and how much of unreacted NaOH remained in the solution? Mr(NaOH) = 40; Mr(NaCl) = 58.5; Mr {Fe(OH)3} = 107

1. 1.2 mol of Fe(OH)3
2. 1.8 mol of Fe(OH)3
3. 48 g of NaOH
4. 192.6 g of Fe(OH)3
5. 5.4 mol of NaCl
6. 6 mol of NaCl
7. 0.6 mol of NaOH
8. 24 g of NaOH

# Dissolving magnesium in sulfuric acid gave 36 g of magnesium sulfate. Calculate the amount of magnesium and 80 % (w %) sulfuric acid needed to prepare the product. How much of hydrogen was formed during the reaction? Ar(Mg) = 24;

**Mr(H2SO4) = 98; Mr(MgSO4) = 120**

1. 29.4 g of H2SO4
2. 6.72 dm3 of hydrogen
3. 36.75 g of H2SO4
4. 1.2 g of hydrogen
5. 0.3 mol of Mg
6. 0.6 g of hydrogen
7. 7.2 g of Mg
8. 0.6 mol of Mg

# Which of the following hydroxides in given quantity can fully neutralize 0.4 mol of oxalic acid:

1. 0.6 mol of NaOH
2. 0.4 mol of Ba(OH)2
3. 0.8 mol of LiOH
4. 0.4 mol of Mn(OH)2
5. 0.3 mol of Al(OH)3
6. 0.3 mol of Bi(OH)3
7. 0.7 mol of KOH
8. 0.4 mol of CsOH

# There is 30 cm3 of the LiOH solution in the titration flask. To neutralize it, we need 21 cm3 of 0.1 mol.dm-3 hydrochloric acid solution. What is the concentration of LiOH solution:

a) 0.140 mol.l-1

b) 0.070 mol.l-1

1. 70 mmol.l-1
2. 140 mmol.l-1
3. 2.1 mol.l-1

f) 0.21 mol.l-1

g) 1.4×10-4 mol.l-1

h) 7×10-2 mol.l-1

# What is the concentration of HNO3 solution if 30 ml of this solution is neutralized with 36 ml of a 0.1 mol.dm-3 LiOH solution, or how much of LiOH is present in these 36 ml of solution before neutralization? Mr(LiOH) = 24

a) 0.24 mol.l-1

b) 0.12 mol.l-1

1. 86.4 mg of LiOH
2. 83 mmol.l-1
3. 120 mmol.l-1
4. 24 mmol.l-1
5. 0.0864 g of LiOH
6. 0.0036 g of LiOH

# 100 ml of a solution contains 0.1 mol of sulfuric acid. How many grams of barium hydroxide (Mr = 171) are needed to neutralize this solution or how many milliliters of 0.2 mol/l solution of Ba(OH)2 are needed to neutralize sulfuric acid?

a) 17.1 g

b) 34.2 g

c) 68.4 g

1. 171 g
2. 0.5 l Ba(OH)2 solution
3. 20 ml Ba(OH)2 solution
4. 500 ml Ba(OH)2 solution
5. 50 ml Ba(OH)2 solution

# 50 ml of a solution contains 1.5 mol of sulfuric acid. How many grams or moles of sodium hydroxide (Mr = 40) are needed to neutralize this solution?

1. 60 g
2. 30 g
3. 120 g
4. 3 g
5. 3 mol
6. 60 mol
7. 120 mol
8. 90 mol

# A reversible reaction expressed by the reaction A + 2B C has the following concentrations of substances in the equilibrium: [A] = 0.5 mol.l-1, [B] = 1.6 mol.l-1,

**[C] = 2.56 mol.l-1. Calculate the equilibrium constant and the initial concentrations of substances A and B:**

|  |  |  |
| --- | --- | --- |
| a) K = 3.2; | [A] = 2.1 mol.l-1; | [B] = 4.16 mol.l-1 |
| b) K = 2; | [A] = 2.1 mol.l-1; | [B] = 4.16 mol.l-1 |
| c) K = 2; | [A] = 3.06 mol.l-1; | [B] = 6.72 mol.l-1 |
| d) K = 6.4; | [A] = 0.5 mol.l-1; | [B] = 1.6 mol.l-1 |
| e) K = 0.5; | [A] = 1.0 mol.l-1; | [B] = 3.2 mol.l-1 |
| f) K = 0.5; | [A] = 3.06 mol.l-1; | [B] = 6.12 mol.l-1 |
| g) K = 0.32; | [A] = 2.1 mol.l-1; | [B] = 3.2 mol.l-1 |
| h) K = 0.3125; | [A] = 3.56 mol.l-1; | [B] = 5.76 mol.l-1 |

# In the equilibrium state the substances of the reaction N2 + 3 H2 2 NH3 are at the concentrations: [N2] = 4.5 mol/l, [H2] = 7 mol.l-1, [NH3] = 8 mol.l-1. What were the initial concentrations of hydrogen and nitrogen? What is the equilibrium constant of the reaction under these conditions?

a) [H2] = 12.5 mol.l-1

b) [H2] = 31 mol.l-1

c) K = 4

d) [N2] = 3.5 mol.l-1

e) [H2] = 5 mol.l-1

f) K = 4.15×10-2

g) [N2] = 8.5 mol.l-1

h) [H2] = 19 mol.l-1

# By heating, the phosphorus pentachloride is decomposed according to the following equation: PCl5 PCl3 + Cl2. At a certain temperature the two out of eight moles of PCl5 were decomposed in a 10-liter closed flask. Calculate the equilibrium constant of the reaction at this temperature and the concentration of the compounds (mol.l-1), in the equilibrium:

a) K = 0.1

b) [PCl3] = 0.6

c) [PCl3] = 0.2

d) K = 0.067

e) [Cl2] = 0.2

f) [PCl5] = 0.6

g) [PCl3] = 2

h) [Cl2] = 2

# The equilibrium constant of the esterification reaction of methanol with acetic acid is one. Mark the correct amount (moles) of the individual components of the equilibrium system, if 5 moles of methanol and 8 moles of acetic acid are mixed:

1. methanol = 4.92
2. acetic acid = 1.92
3. ester = 1.92
4. water = 3.08
5. methanol = 1.92
6. acetic acid = 4.92
7. ester = 3.08
8. water = 1.92

# The equilibrium of the following reaction H2 + I2 2HI was stabilized at the following concentrations: [H2] = 0.50 mol.l-1, [I2] = 0.30 mol.l-1 and [HI] = 1.6 mol.l-1. Calculate the initial concentrations (mol.l-1) of iodine and hydrogen and mark the correct concentrations of the individual substances. Mark the correct value of the equilibrium constant:

a) [H2] = 1.1

b) [I2] = 1.1

c) [H2] = 1.6

d) K = 0.56

e) [H2] = 1.3

f) [I2] = 1.3

g) [HI] = 0.8

h) K = 17.067

# What is the osmotic pressure of the potassium chloride solution at 30 °C if 3 g of KCl is dissolved in 0.5 liter of the solution? What is the concentration of osmotically active particles? Mr(KCl) = 75; R = 8.32 JK-1mol-1

1. the osmotic pressure is 201.8 kPa
2. the osmotic pressure is 403.6 kPa
3. the osmotic pressure is 40 kPa
4. the osmotic pressure is 20 kPa
5. the concentration of osmotically active particles is 0.16 mol.l-1
6. the concentration of osmotically active particles is 0.08 mol.l-1
7. the concentration of osmotically active particles is 2.4 mol.l-1
8. the concentration of osmotically active particles is 0.04 mol.l-1

# Calculate the osmotic pressure of the solution at 37 °C if 75 mmol of non-electrolyte is dissolved in 250 ml of the solution. What is the concentration of osmotically active particles in the solution? What is the resulting solution with regard to saline solution?

**R = 8.32 JK-1mol-1**

1. the osmotic pressure of the non-electrolyte solution is 193.5 kPa
2. the osmotic pressure of the non-electrolyte solution is 92.35 kPa
3. the osmotic pressure of the non-electrolyte solution is 774.13 kPa
4. the concentration of osmotically active particles in the solution is 0.3 mol.l-1
5. the concentration of osmotically active particles in the solution is 75 mmol.l-1
6. the resulting solution is isotonic to the NaCl physiological solution
7. the resulting solution is hypertonic to the NaCl physiological solution
8. the resulting solution is hypotonic to the NaCl physiological solution

# What is the molecular weight of the non-electrolyte, or which substance can it be, if one liter of the solution contains 7.256 g of the substance and the osmotic pressure of the solution is 100 kPa at 25 °C? R = 8.32 JK-1mol-1

1. the molecular weight is 15
2. the molecular weight is 150
3. the molecular weight is 180
4. the non-electrolyte can be ribose
5. the non-electrolyte can be fructose
6. the non-electrolyte can be glucose
7. the non-electrolyte can be sucrose
8. the non-electrolyte can be glycerol

# The osmotic pressure of 250 ml of the solution containing 3 g of saccharide is 200 kPa at 25 °C. Determine which saccharide can it be. What is the concentration of the saccharide solution? What is the molecular weight of the saccharide?

**R = 8.32 JK-1mol-1; Ar(C) = 12; Ar(H) = 1; Ar(O)= 16**

1. it can be sucrose
2. it can be galactose
3. it can be arabinose
4. it can be xylulose
5. the concentration of solution is 0.04 mol.l-1
6. the concentration of solution is 0.08 mol.l-1
7. the molecular weight of saccharide is 150
8. the molecular weight of saccharide is 180

# What is the molecular weight of carbohydrate, if osmotic pressure of the solution containing 12.61 grams of carbohydrate in 300 ml of the solution is 700 kPa at 27 °C?

**Which carbohydrate could it be? R = 8.32 JK-1mol-1**

a) 150

b) 180

c) 312

d) 282

1. sucrose
2. glucose
3. xylulose
4. ribulose

# Calculate the amount of carbon dioxide and water which are formed by oxidation of 20 mol of methane at room temperature. Ar(C) = 12; Ar(O) = 16; Ar(H) =1

1. 40 moles of CO2
2. 20 moles of CO2
3. 44.8 liters of CO2
4. 448 liters of CO2
5. 20 moles of H2O
6. 40 moles of H2O
7. 720 g of H2O
8. 360 g of H2O

# What volume or how many moles of oxygen are consumed in the combustion

**of 44.8 dm3 of propane assuming the volumes of both gases are measured under the same conditions? How many g or mol of H2O are formed during this process?**

**Ar(C) = 12; Ar(O) = 16; Ar(H) = 1**

1. 224 liters of O2 are consumed
2. 112 liters of O2 are consumed
3. 5 moles of O2 are consumed
4. 10 moles of O2 are consumed
5. 4 moles of H2O are formed
6. 8 moles of H2O are formed
7. 144 g of H2O are formed
8. 72 g of H2O are formed

# Which volume or how many moles of hydrogen are released during the reaction

**of 92 mg of sodium with 5 mmol of ethanol at room temperature? What % of ethanol remains unreacted? Ar(Na) = 23**

1. 4 mmol of H2 are released
2. 0.002 mol of H2 is released
3. 44.8 ml of H2 are released
4. 0.0448 liter of H2 is released
5. 80 % of ethanol remain unreacted
6. 20 % of ethanol remain unreacted
7. 0.2 mmol of H2 is released
8. 44.8 liters of H2 are released

# Calculate the mass of sugar cane with 20 % content of sucrose and the mass of sucrose which has to be hydrolyzed to prepare 1 tonne of glucose?

**Ar(H) = 1; Ar(C) = 12; Ar(O) = 16; Mr(sucrose) = 342**

1. 9.5 tonnes of sugar cane
2. 1,900 kg of sugar cane
3. 9,500 kg of sugar cane
4. 1.9 tonnes of C12H22O12
5. 1.9 tonnes of sugar cane
6. 1,900 kg of sucrose

g) 9,500 kg of C12H22O11

h) 1,900 kg of C12H22O11

# Explosive mixture of methane with the air contains 5 to 15 volume % of methane. Calculate the mass and the amount of substance of methane in the volume of 1.12 m3 of mixture at the lower and upper limits of explosiveness. Ar(C) = 12; Ar(H) = 1

a) 40 - 120 g

b) 40 - 120 kg

c) 35.7 - 107.1 g

d) 2.5 - 7.5 mol

e) 2.5 - 7.5 kmol

f) 40 - 120 ml

g) 2,500 - 7,500 mmol

h) 0.04 - 0.12 kg

# What amount of the air and oxygen is needed to complete the combustion of 26 g of acetylene? Ar(C) = 12; Ar(H) = 1; Ar(O) = 16

1. 56 liters of O2
2. 266.66 liters of the air
3. 56 ml of O2
4. 2.5 mol of O2
5. 5 mol of O2
6. 80 g of O2
7. 266.66 ml of the air
8. 0.08 kg of O2

# What volume, mass or amount of substance of ethane is produced in the reaction of 13 g of acetylene with the volume 44.8 liters of hydrogen? Ar(H) = 1; Ar(C) = 12

1. 30 g
2. 1 mol
3. 0.5 mol
4. 11.2 liters
5. 22.4 liters
6. 500 mmol
7. 15 g
8. 0.5 mmol

# Calculate the amounts of ethene and chlorine needed for the preparation of 49.5 g of dichloroethane at room temperature? Ar(Cl) = 35.5; Ar(H) = 1; Ar(C) = 12

1. 22.4 dm3 of chlorine
2. 11.2 liters of Cl2
3. 11.2 liters of ethene
4. 11.2 liters of CH≡CH
5. 35.5 g of Cl2
6. 14 g of ethene
7. 17.75 g of Cl2
8. 14 g of H2C=CH2

# Calculate the mass of benzene that can be prepared from 6.72 dm3 of acetylene, if the amount of product is only 50 % of the theoretical amount. Ar(C) = 12; Ar(H) = 1

a) 8.2 g of benzene

b) 3,900 mg C6H6

1. 3.9 g of benzene
2. 3.9 g of C6H10
3. 7.8 g of C6H6
4. 3.9 g of C6H6

g) 3.9×10-3 kg of C6H6

h) 3.9 g of C6H12

# Calculate the mass of toluene that can be prepared by the reaction of 26 g of benzene with chloromethane. How much chloromethane is consumed during the reaction? Ar(Cl) = 35.5; Ar(C) = 12; Ar(H) = 1

1. 30.66 mg of toluene
2. 46 g of toluene
3. 30.66 g of toluene
4. 0.333 mol of CH3Cl
5. 16.83 g of CH3Cl
6. 16.83 g of CHCl3
7. 0.333 mol of CHCl3
8. 16.83 g of CH2Cl2

# Calculate the mass of toluene needed for preparation of 113.5 g of trinitrotoluene (TNT), if the amount of product is only 50 % of the theoretical amount. Ar(N) = 14;

**Ar(C) = 12; Ar(H) = 1; Ar(O) = 16; Mr(TNT) = 227**

1. 92 g
2. 184 g
3. 92 mg

d) 0.092 kg

e) 92 kg

f) 92×103 mg

g) 92 µg

h) 92×10-3 kg

# For hydrolysis of 6 g of an unknown ester of formic acid we used 50 ml of sodium hydroxide solution with concentration of 2 mol.l-1. Determine which ester it is.

**Mr(NaOH) = 40; Ar(C) = 12; Ar(O) = 16; Ar(H) = 1**

1. methyl methanoate
2. ethyl formate
3. CH3COOCH3
4. HCOOCH3
5. HCOOC2H5
6. CH3COONa
7. methyl formate
8. CH3OOCH

# What amount of hydrogen or alcoholate are produced when 23 g of sodium reacts with 23 g of ethanol (volume of gas is measured at room temperature)? Ar(C)= 12;

**Ar(H) = 1; Ar(O) = 16; Ar(Na) = 23**

1. 0.5 mol of H2
2. 5.6 liters of H2
3. 11.2 liters of H2
4. 0.25 mol of H2
5. 34 g of CH3ONa
6. 34 g of C2H5ONa
7. 34 g of CH3CH2ONa
8. 68 g of C2H5ONa

# What amount of phenolate is prepared from KOH and phenol, if 47 grams of each reactant are used? Ar(C) = 12; Ar(O) = 16; Ar(H) = 1; Ar(K) = 39

1. 66 g of C6H5OOK
2. 110.8 g of C6H5OK
3. 66 g of C6H5OK
4. 132 g of C6H5OK
5. 66 g of C6H5COOK
6. 0.5 mol of C6H5OK
7. 0.5 mol of C6H5COOK
8. 0.066 kg of C6H5OK

# What amounts of formic acid and ethanol are needed to prepare 222 g of ethyl formate? Mr(ethanol) = 46; Mr(formic acid) = 46; Mr(ethyl formate) = 74

1. 138 g of HCOOH
2. 138 g of CH3CH2OH
3. 138 g of C2H5OH
4. 138 g of CH3OH
5. 3 mol of HCOOH
6. 3 mol of C2H5OH
7. 3 mol of CH3CHO
8. 138 kg of HCOOH

# How many grams and moles of ethanol are needed for the preparation of 22 g of ethyl acetate if the amount of produced ester is only 25 % of the theoretical amount?

**Mr(ethanol) = 46; Mr(ethyl acetate) = 88**

1. 46 g of CH3CHO
2. 1 mol of CH3CHO
3. 46 g of CH3CH2OH
4. 11.5 g of C2H5OH
5. 1 mol of CH3CH2OH
6. 0.25 mol of C2H5OH
7. 1 mol of CH3OH
8. 46 g of CH3OH

# Which combination of elements and their description match:

1. Hg, As, Cd, Pb - all of them are toxic to living organisms
2. Ca, Mg, Na, K, Cl, Fe - all of them are biogenic elements
3. Zn, Mn, Cu, Mo, Se - all of them are biogenic microelements
4. Cu, Se, Zn, I, Mo - all of them are biogenic macroelements
5. Pb, Hg, Cd, As - all of them are biogenic microelements
6. C, H, O, N - these elements are the most abundant in organic compounds
7. C, H, O, N, S, P - most of bioorganic compounds are formed out of these elements
8. O, N, S, Cl - these elements are the most abundant in organic compounds

# The electron configuration of the carbon atom in the excited state is:

a) 1*s*2 2*s*2 2*p*2

1. 1*s*2 2*s*2 2*p*x1 2*p*y1 2*p*z1
2. 1*s*2 2*s*1 2*p*x1 2*p*y1 2*p*z1

d) 1*s*2 2*s*1 2*p*3

e) 1*s*2 2*s*2 2*p*3

f) 1*s*2 2*s*1 2*p*x12*p*y2

g) 1*s*2 2*s*1 2*p* 3

x

h) the same as in the ground state

# Characteristics of organic compounds depend:

1. on the type of functional groups
2. on the internal arrangement of the atoms in the molecule
3. on the type of atoms in the molecule
4. on the constitution of molecules
5. on the structure of molecules
6. mainly on the number of carbon atoms in the molecule
7. only on the order of atoms of elements in the molecule
8. only on the types of bonds

# In the hydrocarbon secondary carbon atoms



**are marked by the numbers:**

1. 1, 6 and 7
2. 1, 2 and 8
3. 5 and 6
4. 3 and 5
5. 1 and 6
6. 2 and 4
7. 7 and 8

h) 1, 3, 5 and 6

# In the methane molecule:

1. binding angles are 109° 28’
2. binding angles are 120°
3. binding angles are 180°
4. a carbon atom is located in the center of a regular tetrahedron
5. atoms of hydrogen are located at the vertices of a regular tetrahedron
6. all atoms lie in one plane
7. all atoms lie in one line
8. atom of carbon is four bonded

# The compound with the formula:



1. contains the secondary carbon atom marked by the number 2
2. contains the secondary carbon atom marked by the number 3
3. contains secondary carbon atoms marked by the numbers 2 and 3
4. is butanal
5. is acetaldehyde
6. is formaldehyde
7. is butanone
8. is butanol

# Which of the following compounds contain a tertiary carbon atom:

a) CH3-CH2-OH b)



c)



1. (CH3)3C-OH
2. HO-CH2-CH2-OH f)



g)



h) Cl3C-COOH

# Constitutional isomers are:

1. compounds which have the same molecular formula but different structural formulas
2. isopentane and 2-methylbutane
3. ethyl alcohol and dimethyl ether
4. methanol and dimethyl ether
5. n-pentane and isopentane
6. CH3CH2OH and CH3-O-CH3
7. butanone and propanone h)



# Which of the following compounds exhibits cis-trans isomerism:

1. 1-butene (but-1-ene)
2. 2-butene (but-2-ene)
3. 2-hexene (hex-2-ene)
4. 3-hexene (hex-3-ene)
5. 2-methyl-2-butene (2-methylbut-2-ene)
6. 1,2-dichloroethylene
7. 9-octadecenic acid
8. butenedioic acid

# Which of the following structures is the cis isomer:

a)



b)



c)



d)



e)



f)



g)



h)



# Which of the following structures is the trans isomer:

a)



b)

c)



d)



e)



f)

g)



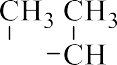
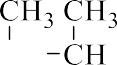
h)



# The pair of compounds CH3-CO-O-CH2-CH3 and CH3-CH2-O-CO-CH3 represents:

1. constitutional isomers
2. tautomers
3. ethyl ester of ethanoic acid
4. the same compound
5. ethyl ester of acetic acid
6. ethyl acetate
7. stereoisomers
8. enantiomers

# Which pairs of compounds are isomers:



a)

b) CH3-O-CH2-CH3 and CH3-CH2-O-CH3 c)



d) and CH3-CH2-CH3



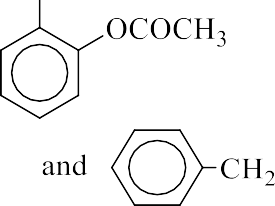
e)



f)



g)



h)

# Which pairs of compounds are isomers:



a)

b)

c)



1. H3C-CH2-O-CH2-CH3 and CH3-O-CH2-CH2-CH3
2. CH3OCH3 and C2H5OH
3. CH3CHO and CH2=CHO g)



h) CHCl3 and CH3Cl

# Isomers cis-trans can form:

1. 2-pentene (pent-2-ene)
2. 1-chloro-1-propene (1-chlor-prop-1-ene)
3. 1,3,5-hexatriene (hexa-1,3,5-triene)
4. 1-pentene (pent-1-ene)
5. propene
6. 3-hexene (hex-3-ene)
7. 2-hexene (hex-2-ene)
8. 2-methyl-2-butene (2-methyl but-2-ene)

# The correctly marked chiral carbon (C\*) atom is in the formula:

1. C6H5-CH(OH) -C\*OOH
2. CH3-C\*H(NH2)-COOH
3. CH3-CH(Cl)-C\*Cl3
4. CH3-C\*H(OH) -COOH
5. CH2(OH) C\*H(OH) CHO
6. HO-CH2-C\*O-CH2OH g)



h)



# Which of the following compounds are optically active:

a)



b)



c)



d)



e)



f)



g)



h)



# Which of the following compounds are optically active:

1. lactic acid
2. citric acid
3. 2-methyl-1-butanol (2-methyl-butane-1-ol)
4. 2-methylpropane
5. dihydroxyacetone
6. glyceraldehyde
7. 2,2-dibromopropane
8. 1,2-dibromopropane

# Which of the following compounds is optically active:

a)



b)



c)



d)



e)



f)



g)



h)



# Alkynes are hydrocarbons:

1. which can undergo addition reactions
2. with the general formula CnH2n-2
3. with the triple bond in the molecule
4. which form a homologous sequence
5. more reactive than alkanes
6. unsaturated
7. sensitive to oxidation
8. which form acetylides with metals

# Alkyls, R-:

1. are one bonded groups
2. are derived from alkanes by removing one hydrogen atom
3. have the general formula CnH2n+1
4. are, for example, methyl and propyl
5. are also called aryls
6. are phenyl and naphthyl
7. are formyl and acetyl
8. are benzyl and benzoyl

# To the compound of the formula assign the correct systematic



**or trivial name:**

1. 2-methyl-1,3-butadiene (2-methylbuta-1,3-diene)
2. chloroprene
3. 2-methyl-1,4-butene (2-methylbut-1,4-ene)
4. 3-methyl-1,3-butadiene (3-methylbuta-1,3-diene)
5. isoprene
6. methyl isoprene
7. 2-methyl-1,4-butadiene (2-methylbuta-1,4-diene)
8. styrene

# Benzyl is one bonded group derived from:

1. benzoic acid
2. benzene
3. toluene
4. phenol
5. cresol
6. styrene
7. ethylbenzene
8. naphthalene

# The compound with the formula represents:



1. a tertiary amine
2. an imine
3. a substitutional derivative of propane
4. a weak base
5. nitropropane
6. 2-aminopropane
7. a secondary amine
8. a primary amine

# The compound with the formula C6H5-CH=CH2 is:

1. a monomer for the polystyrene production
2. a monomer for the PVC production
3. cumene
4. ethenylbenzene
5. ethylbenzene
6. vinylbenzene
7. styrene
8. an aromatic hydrocarbon

# is:



1. methanol
2. acetaldehyde
3. ketone
4. methyl alcohol
5. methanoic acid
6. formaldehyde
7. aldehyde
8. carbonyl compound

# CH3-CHO is:

1. acetaldehyde
2. formaldehyde
3. acetylene
4. acetone
5. ethanal
6. a tautomer of vinyl alcohol
7. a compound formed by the oxidation of a secondary alcohol
8. a compound by the oxidation of which formic acid is formed

# The compound with the formula is:



1. glyceraldehyde
2. dihydroxyacetone
3. oxo-compound
4. aldehyde
5. 2,3-dihydroxypropanal
6. a product of the glycerol reduction
7. an optically active compound
8. a compound containing one asymmetric carbon atom in the molecule

# Indicate the systematic name of the compound:



1. 3-methyl-3-butenic acid (3-methylbut-3-enic)
2. ß-methyl-3-butenic acid
3. fumaric acid
4. acrylic acid
5. 2-methyl-2-butenoic acid (2-methylbut-2-enic)
6. 3-methyl-2-butenoic acid (3-methylbut-2-enic)
7. 2-methyl-3-butenoic acid (2-methylbut-3-enic)
8. isobutyric acid

# Indicate pairs where the correct name is assigned to the formula:

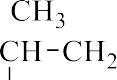
1. 4-methylpentane



1. 2-methylbutane



1. 4-methylpentane



1. 2,4-dimethylhexane
2. 4,4-dimethylpentane
3. C6H5-CH=CH2 vinyl benzene
4. C6H5-CH3 toluene
5. CH2=CH-CH=CH2 1,3-butadiene (buta-1,3-diene)

# The addition of water to ethene:

1. provides vinyl alcohol
2. leads to the disappearance of the double bond
3. is dehydration
4. is electrophilic addition
5. can be catalyzed by sulfuric acid
6. is a reaction by which ethanol is formed
7. is the basis of industrial ethanol production
8. is controlled by the Markovnikov's rule

# The reaction of methane with chlorine:

1. is a radical chain reaction
2. consists of initiation, propagation and termination
3. is a heterolytic substitution reaction
4. is a homolytic substitution reaction
5. is an addition nucleophilic reaction
6. is performed by irradiating the reaction mixture with UV radiation
7. is carried out at the temperature around 25 °C
8. provides sequentially mono-, di-, tri- and tetrachloromethane

# By the hydrogenation of ethylene the following compounds can be formed:

1. ethene
2. acetylene
3. a saturated hydrocarbon
4. acetaldehyde
5. ethanol
6. ethane
7. ethyne
8. alkane

# Which of the following compounds is formed by the addition of hydrogen chloride to 1-butene and 2-butene:

a)



b)



c)



1. halogenoalkane
2. 2-chlorobutane
3. 1-chlorobutane
4. an optically active compound
5. a compound with a chiral carbon atom

# By the reaction CH2=CH-CH3 + HBr the following compound is formed:

1. 2-bromopropane
2. 1-bromopropane
3. bromoform
4. isoprene
5. 1-bromopropene
6. 2-bromopropene
7. alyl bromide
8. vinyl bromide

# By the addition of water to acetylene, the following compound can be formed:

1. a non stable vinyl alcohol
2. ethanal
3. ethyl alcohol
4. acetylbenzene
5. acetaldehyde
6. formaldehyde
7. ethanol
8. acetylide

# Reaction R-CH2-CH2-NH2 R-CH=CH2 + NH3 is:

1. deamination of the secondary amine
2. an elimination
3. a substitution
4. an addition
5. deamination of the tertiary amine
6. deamination of the primary amine
7. a deamination
8. a chain reaction

# By the benzene nitration into the second stage, the following compound is formed as the main product:

1. 1,2-dinitrobenzene
2. 1,4-dinitrobenzene
3. 1,3-dinitrobenzene
4. m-dinitrobenzene
5. o-dinitrobenzene
6. nitrobenzene
7. p-dinitrobenzene
8. a substitutional derivative of benzene

# To the electrophilic substitutions of arenes we include:

1. chloration
2. bromation
3. hydrogenation
4. oxidation
5. nitration
6. sulfonation
7. acylation
8. alkylation

# Nucleophilic substitution reactions are typical for:

1. alkynes
2. alcohols
3. phenols
4. arenes
5. alkenes
6. aromatic hydrocarbons
7. aliphatic hydrocarbons
8. halogenoalkanes

# Indicate pairs with the correct name assigned to the formula:

1. CH3Br bromomethane
2. CH2=CH-Br vinyl bromide
3. C5H5-Br bromobenzene
4. C2H5-NO nitroethane
5. C2H5CHO propanol
6. H2C=O methanal
7. CH3-CO-CH3 acetone
8. CH3CHO formaldehyde

# Which of the following reactions belong to elimination:

1. deamination
2. hydration
3. dehydration of ethanol to ethene
4. deamination of amino acid to unsaturated acid
5. dehydrogenation
6. hydrogenation
7. dehydration
8. hydrolysis

# Calcium acetylide:

1. is compound with the formula (C≡C)Ca
2. is compound with the formula (C≡C)2Ca
3. is calcium carbide
4. is salt of acetylene
5. by water is decomposed into acetylene
6. is hydrolyzed to acetylene
7. with the water is decomposed to ethyne
8. is formed by substitution of hydrogen cations in the molecule of acetylene by the cation of a metal

# OH-, Cl-, and NH3 are:

1. heterolytic reagents
2. homolytic reagents
3. nucleophilic reagents
4. electrophilic reagents
5. radicals
6. donors of electrons in a chemical reaction
7. acceptors of electrons in a chemical reaction
8. anions or they contain a lone (free) electron pair in their molecule

# H+, H3O+, Br+ are:

1. homolytic reagents
2. nucleophilic reagents
3. heterolytic reagents
4. electrophilic reagents
5. donors of electrons
6. acceptors of electrons
7. radicals
8. cations

# Electrophilic additions:

1. are typical for alkynes
2. lead to the disappearance of π - bonds
3. are typical for alkenes
4. are typical for alkanes
5. are typical for unsaturated hydrocarbons
6. are typical for aromatic hydrocarbons
7. begin with an electrophile attack
8. are reactions with the synthesis of carbocation as the fastest stage in the reaction mechanism

# 315. NO2+:

1. is a nucleophilic reagent
2. is formed by the reaction of nitric and sulfuric acids
3. is formed by the reaction of nitrous and sulfuric acids
4. reacts with benzene to form aniline
5. is a nitronium ion
6. is a reagent for the electrophilic nitration
7. is formed by the reaction of nitric and sulfurous acids
8. during nitration it replaces a proton in the benzene molecule by the nitro group

# Nitration of benzene is:

1. a reaction of aniline formation
2. an electrophilic substitution
3. a nucleophilic substitution
4. a reaction of benzene with the HNO3 + H2SO4 mixture
5. a reaction of benzene with a nitrating mixture
6. a reaction of benzene with a nitronium cation
7. a reaction of nitrobenzene synthesis
8. a reaction of nitrosobenzene synthesis

# Radical addition is the reaction of benzene with:

1. bromine under FeBr3 catalysis
2. a mixture of nitric and sulfuric acids
3. acetyl chloride under AlCl3 catalysis
4. chloroethane under AlCl3 catalysis
5. Cl2 under FeCl3 catalysis
6. Cl2 by the UV radiation
7. H2 under Pt catalysis
8. a nitration mixture

# m- (meta-) orienting substituents on the aromatic ring are:

1. -COOH
2. -C≡N
3. -CH2CH3
4. -Br
5. -NO2
6. -SO3H
7. -OH
8. -NH2

# o- and p- (ortho- and para-) orienting substituents on the aromatic ring are:

1. -NO2
2. -OH
3. -COOH
4. -CH3
5. -Br
6. -COR
7. -NH2
8. -Cl

# Which of the following compounds are soluble in water:

1. glucose
2. CH3(CH2)16COOH
3. CH3COOH
4. cholesterol
5. urea
6. triacylglycerols
7. saccharose
8. alanine

# Which of the following compounds are aromatic:

1. cresol
2. hydroquinone
3. p-benzoquinone
4. 1,3-cyclohexadiene
5. 1,4-benzoquinone
6. toluene
7. benzylchloride
8. resorcinol

# Dehydrogenation of ethanol is:

1. a reduction of ethanol
2. an oxidation of ethanol
3. an oxidation-reduction reaction
4. a reaction of ethane synthesis
5. a reaction of ethene synthesis
6. a reaction of acetaldehyde synthesis
7. a reaction of ethanal synthesis
8. a reaction of formaldehyde synthesis

# Hydrogenation of acetone is:

1. associated with isomerization of acetone to acetaldehyde
2. the oxidation of acetone
3. the reduction of acetone by hydrogen
4. the addition of hydrogen to the oxo group of acetone
5. associated with the formation of a secondary alcohol
6. associated with the formation of a primary alcohol
7. the reaction of 2-propanol synthesis
8. the reaction of 1-propanol synthesis

# Choose the correct reactions:

1. CH≡CH + HCl CH2=CHCl
2. CH≡CH + HBr CH2-CHBr
3. CH≡CH + Br2 Br2CH-CHBr2
4. CH≡CH + 2Br2 BrCH=CHBr e)



f)



g)



h)



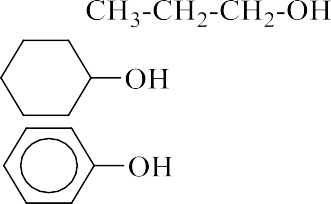
# Choose the correct reactions or schemes:



a) 



b)



c) 



d)

e) 

1. CaC2 + H2O C2H2 + CaOH
2. CaC2 + 2H2O C2H2 + Ca(OH)2 h) 



# Reaction of the complete combustion of compounds is:

a) C6H5-CH3 + 9 O2 7 CO2 + 4 H2O

b) CH3-(CH2)3-CH3+ 8 O2 5 CO2 + 6 H2O

c) CH4 + O2 CH2O + H2O

d) 2 CH4 + 4 O2 2 CO2 + 4 H2O

1. 2 C6H6 + 3O2 2 CH3COOH + 2 H2O
2. CH2=CH2+ 2 KMnO4+ 4 H2O 3 HO-CH2-CH2-OH + 2 MnO2 + 2 KOH

g) C6H12O6 + 6 O2 6 CO2 + 6 H2O

h) C16H32O2 + 23 O2 16 CO2 + 16 H2O

# Choose the correct reactions or schemes:

a) 



b)



c)



d) 



e)  



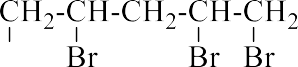
f)  



g)  



h) 



# Which schemes illustrate the formation of the major product of the substitution reaction:

a)



b) 



c)



d)



e)



f) 



g)



h)

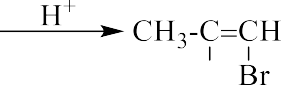


# Choose the correct reactions:

a) 



b) 



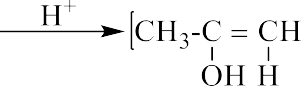
c)



d)



e)



f)



g) 



h)



# From ethylene the following compound can be formed:

1. styrene
2. ethanol
3. ethylene glycol
4. vinyl chloride
5. chlorinated solvents
6. allyl chloride
7. glycerol
8. ethylene oxide

# Benzyl chloride:

1. is chloromethyl benzene
2. is a substitutional derivative of toluene
3. is an aromatic compound
4. is a derivative of benzoic acid
5. is identical to benzoyl chloride
6. is an unsaturated compound
7. is a halogen derivative of toluene
8. is identical to chlorobenzene

# Compound CH2=CHCl:

1. is a cancerogenic gas
2. belongs to freons
3. polymerize to polyvinyl chloride
4. is chloroethylene
5. is chloroethene
6. is vinyl chloride
7. is styrene
8. is ethyl chloride

# The reaction is:

1. an addition
2. a radical substitution
3. a reaction of bromoform synthesis
4. bromation of methane
5. a hydrolysis
6. bromation
7. an electrophilic substitution
8. a nucleophilic substitution

# Full hydrogenation of benzene leads to the production of:

1. methylbenzene
2. cyclohexadiene
3. cyclohexatriene
4. dioxane
5. cycloalkane
6. cyclohexene
7. toluene
8. cyclohexane

# The compound CHCl3 is:

1. a halogen derivative of ethane
2. chloroform
3. trichloromethane
4. trichloroethylene
5. carbon tetrachloride
6. methylene chloride
7. halogenoalkane
8. a volatile liquid

# The compound with the formula is:



1. an aromatic compound
2. benzyl chloride
3. a substitution derivative of benzoic acid
4. a functional derivative of benzoic acid
5. benzoyl chloride
6. styrene
7. chloride of benzoic acid
8. halogenoalkane



# The bond of bromine with the carbon atom in the chain:

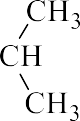
1. is a polar covalent bond
2. causes a negative induction effect
3. causes a positive induction effect
4. causes a mesomeric effect
5. is non-polar
6. is covalent
7. is ionic
8. breaks homolytically in the chemical reaction

# Negative inductive effect -I is caused by the following group:

1. -NO2
2. -CH3
3. -Cl
4. -OH
5. -Br
6. -CH2CH3
7. -NH2
8. -I

# The positive inductive effect +I is caused by the following group:

1. -Br
2. -CH2-CH3
3. -F d)



1. -I
2. -OH
3. -CH3
4. -NO2

# Acetyl is:

a)



b) CH3-CO- c)



1. CH3-CO-O-
2. -OC-CH3
3. HC-CO-
4. R-CO-
5. the acyl derived from acetic acid

# Organic compounds with the characteristic -SH group are:

1. sulfur analogues of hydroxy derivatives of hydrocarbons
2. sulfides
3. thioalcohols
4. sulfonic acids
5. thiols
6. disulfides
7. thiolates
8. sulfites

# Dimethyl disulfide is formed by the oxidation of:

1. ethanethiol
2. methanethiol
3. ethylene glycol
4. ethene
5. methanediol
6. sulfane
7. cysteine
8. thiophene

# D-glyceraldehyde:

1. contains an asymmetric carbon atom in the molecule
2. is formed by the hydrogenation of glycerol
3. contains one chiral carbon atom in the molecule
4. contains two chiral carbon atoms in the molecule
5. is formed by the mild oxidation of glycerol
6. is formed by the mild oxidation of 1,2,3-propanetriol
7. is an optically active compound
8. contains the carbonyl group in the molecule

# Which of the following reactions may proceed:

1. oxidation of ethanol to acetaldehyde
2. oxidation of formaldehyde to formic acid
3. reduction of methanal to methanoic acid
4. oxidation of methanol up to formic acid
5. reduction of keto acid to hydroxy acid
6. oxidation of 1-propanol to propanal
7. oxidation of acetaldehyde to acetic acid
8. oxidation of 2-propanol to acetone

# Which of the following alcohols is very toxic and causes the blindness:

1. CH3-CH2-OH
2. CH3OH
3. CH3-CH2-CH2-OH d)



1. methanol
2. C2H5OH
3. methyl alcohol h)



# Hydroxy derivatives of hydrocarbons include:

1. sorbitol
2. alcohols
3. phenols
4. ketones
5. acetals
6. ethers
7. diols
8. triols

# Primary alcohols include:

1. 2-methyl-2-propanol (2-methylpropane-2-ol)
2. 2-methyl-1-propanol (2-methylpropane-1-ol)
3. 1-butanol (butane-1-ol)
4. 2-butanol (butane-2-ol)
5. hydroquinone
6. ethane diol
7. 1-propanol (propane-1-ol)
8. 2-propanol (propane-2-ol)

# Which of the following compounds belong to secondary alcohols:

a)



1. HO-CH2-CH2-OH
2. CH3(CH2)6CH2-OH d)



e) CH3CH2OH f)



1. cyclohexanol
2. benzylalcohol

# Hydroquinone belongs to:

1. aromatic alcohols
2. phenols
3. benzoquinones
4. aliphatic alcohols
5. dihydroxybenzenes
6. naphthols
7. cresols
8. ketones

# Which of the following compounds can be the product of methanol oxidation:

1. acetaldehyde
2. ethanoic acid
3. acetic acid
4. formic acid
5. methanal
6. formaldehyde
7. methanoic acid
8. acetone

# According to the Brönsted theory, alcohols are:

1. ampholytes
2. hydroxides
3. compounds with amphoteric properties
4. strong acids
5. acceptors of electrons
6. donors of electrons
7. compounds with the -OH group in the molecule
8. either bases or acids depending on the environment

# Which of the following compounds can be the oxidation product of primary alcohol:

1. ether
2. ketone
3. carboxylic acid
4. secondary alcohol
5. aldehyde
6. alcoholate
7. acetone
8. dibasic (dihydric) alcohol

# Which of the following compounds is more acidic than ethanol:

1. 1,3-dihydroxybenzene
2. hydroquinone
3. phenol
4. lactic acid
5. aniline
6. salicylic acid
7. monochloroacetic acid
8. trichloroacetic acid

# Alcohols:

1. form esters with phosphoric acid
2. form esters with organic acids
3. form esters with inorganic acids containing the atom of oxygen in their molecule
4. provide alkenes by dehydration
5. form esters with aldehydes
6. contain the -OH group in the molecule and therefore are strong bases
7. their molecules are connected by hydrogen bonds
8. have higher boiling points than hydrocarbons with the same number of carbon atoms

# Product of dehydrogenation of secondary alcohol is:

1. aldehyde
2. ketone
3. carboxylic acid
4. quinone
5. a compound of the R-CO-R type
6. a compound of the R-CHO type
7. oxo compound
8. alcoholate

# The compound is alcohol:



1. primary
2. secondary
3. monohydric
4. tertiary
5. 2-propanol (propane-2-ol)
6. 1-propanol (propane-1-ol)
7. dihydric
8. trihydric

# Vinyl alcohol is:

1. a monobasic (monohydric) alcohol
2. a dibasic (dihydric) alcohol
3. an unsaturated alcohol
4. a secondary alcohol
5. a tautomer of acetaldehyde
6. unstable, it is quickly rearranged to acetaldehyde
7. a tautomer of ethanal
8. a compound of the formula CH2=CH-OH

# The compound of the formula:



1. is formed by the hydrolysis of fats
2. belongs to alcohols
3. is bound in fats
4. contains an asymmetric carbon in the molecule
5. is glycerol
6. is 1,2,3-propanetriol (propane-1,2,3-triol)
7. is optically active
8. is a trihydric alcohol

# Ethylene glycol:

1. is a component of antifreeze coolant mixtures
2. is a dibasic alcohol
3. is a material for the production of plastics
4. is an oily liquid
5. has a sweet taste
6. is very toxic
7. is used in the food industry
8. is formed by the acidic or alkaline hydrolysis of ethylene oxide

# Picric acid is:

1. an explosive
2. a compound of an acidic nature
3. a basis of the explosive dynamite
4. a basis of the explosive ecrasite
5. monovalent phenol
6. a toxic compound
7. 2,4,6-trinitrophenol
8. a yellow crystalline substance

# Indicate the general formula of an aldehyde:

a)



b)



c)

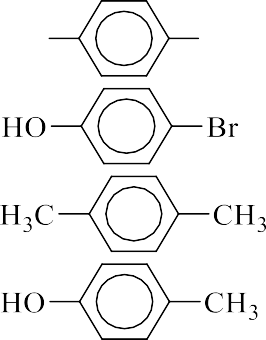


d)



1. R-O-R
2. R-OH
3. R-CHO
4. R-CO-O-R

# Choose the formula of p-cresol from the following compounds:



a)

b)

c)

d)

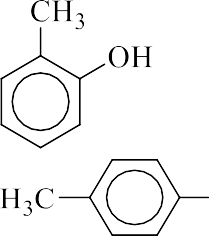
e)



f)



g)



h)

# Which of the following compounds contain a hydroxy group directly bound to the aromatic ring:

1. salicylic acid
2. acetyl salicylic acid
3. aspirin
4. 1-naphthol (naphthalene-1-ol)
5. hydroquinone
6. tyrosine
7. cyclohexanol
8. o-cresol

# Determination of an aldehyde by the Fehling's reagent is based on:

1. the oxidation of an aldehyde
2. the reduction of an aldehyde
3. the hydrogenation of an aldehyde
4. the reduction of Cu2+
5. the formation of Cu2O precipitate
6. the formation of the red precipitate of copper oxide
7. the formation of cupric oxide
8. the oxidation of Cu2+

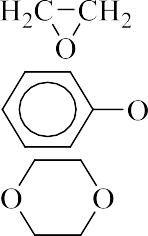
# The compound with the formula can be formed by:



1. the hydrogenation of hydroquinone
2. the reduction of hydroquinone
3. the oxidation of benzaldehyde
4. the oxidation of hydroquinone
5. the reduction of terephthalic acid
6. the dehydrogenation of hydroquinone
7. the dehydrogenation of 1,4-dihydroxybenzene
8. the hydrogenation of 1,4-dihydrobenzene

# Which of the following compounds is an ether:

a)



b)

c)

1. (CH3)3CO-CH3
2. CH3-CH2-CO-O-CH3
3. CH3-O-CH3
4. CH3-CO-O-CO-CH3
5. C6H5-CH2-O-CH3

# During the detection of aldehydes with the Schiff reagent:

1. Cu2+ is precipitated
2. a fuchsine dye is formed
3. a red-violet coloration occurs
4. the oxidation of the aldehyde occurs
5. copper oxide is precipitated
6. a green product is formed
7. sulfur dioxide binds to the aldehyde
8. a red precipitate is formed

# Oxidation of hydroquinone results in the formation of:

1. o-benzoquinone
2. p-benzoquinone
3. quinoline
4. benzoic acid
5. m-benzoquinone
6. an unsaturated cyclic diketone
7. an aromatic compound
8. a substitution derivative of benzene

# Formaldehyde:

1. has reducing properties
2. is oxidized to methanoic acid
3. is oxidized to formic acid
4. is formed by the oxidation of ethanol
5. is formed by the oxidation of methanol
6. is a material for production of plastics
7. is a gas well-soluble in water
8. is methanal



# Compound of the formula is called:

1. phenyl ketone
2. acetylbenzene
3. acetophenone
4. benzoketone
5. phenyl methyl ketone
6. aspirin
7. anisol
8. phenyl methyl ether

# For the group the following statement is true:



1. oxygen has a partial positive charge
2. oxygen has a partial negative charge
3. a nucleophilic reagent may bind to the carbon atom
4. it is a polar group
5. it is also called a carbonyl group
6. it is also called a carboxyl group
7. it is a characteristic group of aldehydes and ketones
8. it is a characteristic group of carbonyl compounds

# Chloroform is a trivial name for:

1. monochloromethane
2. dichloromethane
3. trichloromethane
4. tetrachloromethane
5. a compound of the CHCl3 formula
6. a compound of the CH3Cl formula
7. a compound of the CH2Cl2 formula
8. a compound of the CCl4 formula

# By the dehydration of 1-butanol the following compound is formed:

1. an unsaturated hydrocarbon
2. a saturated hydrocarbon
3. alkene
4. 1-butene (but-1-ene)
5. butyne
6. butadiene
7. 2-butene (but-2-ene)
8. butane

# By the oxidation of ethylene glycol the following compound can be formed:

1. glyoxal
2. glycolic acid
3. glyoxalic acid
4. oxalic acid
5. glycolaldehyde
6. ethanedioic acid (oxalic acid)
7. acetic acid
8. acetone

# The compound with the formula is:



1. pyrocatechol
2. p-benzoquinone
3. dihydric phenol
4. dihydric alcohol
5. 1,4-dihydroxybenzene
6. pyrogallol
7. resorcinol
8. hydroquinone

# Select the reactions or reaction schemes that are correct and their product is yellow-colored iodoform:

1. CH3-CHO + 3 I2 + 4 KOH CHI3 + HCOOK +3 KI + 3H2O
2. CH3OH + 2 I2 + 3 KOH CH3I + 3KI + 2 H2O
3. CH3CH2OH + 4 I2 + 6 NaOH CHI3 + HCOONa + 5NaI + 5H2O
4. CH3 - CO - CH3 + 3 I2 + 4KOH CHI3 + CH3COOK + 3KI + 3H2O

e) 



f) CH4 + I2 CH3I + HI

g) 



h) CH3I + I2 CH2I2 + HI

# By the oxidation of the hydroxyl group of glycerol on the secondary carbon atom the following compound is formed:

1. glyceraldehyde
2. dihydroxyacetone
3. lactic acid
4. malonic acid
5. 1,3-dihydroxy-2-propanone (1,3-dihydroxypropan-2-one)
6. glyoxalic acid
7. glyoxal
8. glycolic acid

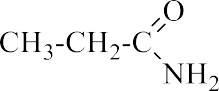
# Which of the following statements about CH3-CH2-SH is true:

1. its name is dimethyl sulfide
2. it is a sulfur analogue of ethanol
3. diethyl disulfide is formed by its oxidation
4. it belongs to thioalcohols
5. it has narcotic effects
6. it is ethanethiol
7. it is a liquid of pleasant smell
8. it is used to odorize natural gas

# The reduction of disulfides results in the formation of:

1. thioethers
2. thiols
3. sulfonic acids
4. substances with the group -S-S-
5. thioesters
6. thioalcohols
7. compounds with the group -SH
8. sulfur analogues of alcohols

# Which of the following compounds belong to amines:

a) 

b)



c) CH3-CO-NH2 d)



e) CH3-CH2-NH-CH3 f)



g)



h) H2N-CO-NH2

# By oxidation of ethanethiol the following compound is formed:

1. CH3-CH2-S-S-CH2-CH3
2. CH3-CH2-S-CH2-CH3
3. CH3-CH2-SH
4. CH3-S-S-CH3
5. CH3-CH2-S-O-S-CH2-CH3
6. CH3-CH2-O-O-CH2-CH3
7. diethyl disulfide
8. dimethyl disulfide

# By the oxidation of CH3-CH2-CH2-CH2-OH to the second step, the following compound is formed:

1. butanol
2. butanal
3. butanoic acid
4. methyl ethyl ether
5. succinic acid
6. butyric acid
7. maleic acid
8. fumaric acid

# The oxidation of the gives rise to:



1. ethenoic acid
2. acetic acid
3. ethanol
4. dimethyl ketone
5. ethanoic acid
6. glycolic acid
7. HOOC-COOH
8. CH3-COOH

# The reduction of propanal results in:

a)



b) CH3-CH2-CH2-OH c)



1. CH3-CH3
2. a primary alcohol
3. 2-propanol (propan-2-ol)
4. 1-propanol (propan-1-ol)
5. vinyl alcohol

# The hydrogenation of acetone can form:

1. a primary alcohol
2. a secondary alcohol
3. isopropyl alcohol
4. a monohydric alcohol
5. 1-propanol (propan-1-ol)
6. propanone
7. propanal
8. 2-propanol (propan-2-ol)

# The reaction between alcohol and acid is:

1. e.g. the reaction which produces glycerol trinitrate
2. e.g. the reaction generating ethyl acetate
3. saponification
4. hydrolysis
5. esterification
6. hydrogenation
7. dehydrogenation
8. oxidation

# The primary alcohol is produced by the reduction of:

1. glycerol
2. benzaldehyde c)



d)



e)



f)



g)



h) acetone

# The oxidation of the glycerol hydroxyl group at the primary carbon atom gives rise to:

1. dihydroxyacetone
2. glyceraldehyde
3. 1,3-dihydroxy-2-oxopropane
4. the simplest aldotriose
5. the simplest ketotriose
6. a compound with a chiral carbon atom in the molecule
7. 1,2,3-propanetriol
8. the aldehyde group

# The dipropylether is a metamer of:

1. methyl ethyl ether
2. ethylbutyl ether
3. methylpentyl ether
4. CH3-O-CH2-CH2-CH3
5. dioxane
6. CH3-CH2-O-CH2-CH2-CH2-CH3
7. vinyl alcohol
8. ethyl ester of ethanoic acid

# By the oxidation of 2-butanol the following compound is formed:

1. butanone
2. butanal
3. CH3-CO-CH2-CH3
4. CH3-CH2-CO-CH3
5. butanoic acid
6. butyric acid
7. CH3-CH2-CH2-CHO
8. CH3-CO-O-CO-CH3

# Which of the following compounds are phenols:

1. p-benzoquinone
2. hydroquinone
3. pyrocatechol
4. resorcinol
5. o-xylene
6. alpha-naphthol
7. o-cresol
8. pyrogallol

# Fehling's reagent is used to prove:

1. aldehydes
2. ketones
3. glucose reduction properties
4. alcohols
5. phenols
6. reducing carbohydrates
7. peptides
8. starch

# Ethers have the general formula:

1. R-O-CO-R
2. R-O-R
3. R-O-O-R
4. R-O-H
5. R-O-NO2
6. R-CO-O-CO-R
7. R-CH(OH)-CO-R
8. R-O-O-H

# Ethers:

1. are excellent lipid solvents
2. form epimers
3. have lower boiling temperatures than their isomeric alcohols
4. form with air oxygen explosive peroxides
5. form hydrogen bonds between the molecules
6. we recognize simple and mixed ethers
7. form metamers
8. form anomers

# The compound is:



1. cyclohexanone
2. phenylmethyl ketone
3. acetylbenzene
4. methoxybenzene
5. phenylmethyl quinone
6. acetophenone
7. methyl benzoate
8. benzoic acid methyl ester

# The compound is:



1. sulfosalicylic acid
2. p-aminobenzoic acid
3. sulfanilic acid
4. salicylic acid
5. benzenesulfonamide
6. p-aminobenzenesulfonic acid
7. aspirin
8. 4-aminobenzenesulfonic acid

# The compound is:



1. benzoic acid
2. p-aminobenzoic acid
3. p-aminosalicylic acid
4. phenylamine
5. a bacterial growth factor
6. a typical antituberculotic compound
7. anthranilic acid
8. a part of the folic acid molecule

# Which compounds can enter esterification?

1. an alcohol and organic acid chloride
2. an organic carboxylic acid and an alcohol
3. an organic carboxylic acid and a strong base
4. an alcohol and water
5. an inorganic oxoacid and a strong base
6. an inorganic oxoacid and an alcohol
7. an aldehyde and an alcohol
8. an organic carboxylic acid anhydride and an alcohol

# Iodoform reaction:

1. is carried out in an alkaline medium
2. is the reaction of I2 with ethanol in an alkaline medium
3. is the reaction of I2 with methanol in an alkaline medium
4. can also be used to prove acetaldehyde
5. is used to distinguish ethanol from methanol
6. is used to distinguish the aldehyde from the ketone
7. is the reaction which also produces CHI3
8. is the reaction which also produces CH3I

# The nitro compounds have the following characteristic group:

1. -NO2
2. -NH2

c) =NH d)



1. ≡N
2. -N=N-
3. -N+≡N
4. -N=O

# The reduction of nitrobenzene results in:

1. 2,4,6-trinitrotoluene
2. aminobenzene
3. nitroethane
4. aniline
5. 2-nitropropane
6. aromatic amine
7. a primary amine
8. pyridine

# Pyrrole belongs to:

1. heterocyclic compounds
2. cyclic hydrocarbons
3. primary amines
4. secondary amines
5. tertiary amines
6. heterocyclic compounds with one nitrogen heteroatom
7. heterocyclic compounds of aromatic character
8. five-membered heterocyclic compounds with two nitrogen heteroatoms

# Amines:

1. are functional derivatives of carboxylic acids
2. if they are primary, they can form ammonium salts with acids
3. form hydrogen bonds with water molecules
4. have nucleophilic properties
5. have an acidic character
6. have a basic character
7. are divided into mono-, di-, triamines, etc., according to the number of amino groups in the molecule
8. are classified to primary, secondary and tertiary

# The primary amines include:

1. aniline
2. CH3NH2
3. (CH3)2NH
4. (CH3)3N
5. H2N-(CH2)6-NH2
6. C6H5-NH2 g)



h) cadaverine

# The compound H2N-CH2-CH2-CH2-CH2-CH2-NH2 is:

1. a primary amine
2. diamine
3. cadaverine
4. putrescine
5. physiologically present in meat
6. a substance produced during the rotting of proteins
7. tetramethylenediamine
8. 1,5-diaminopentane

# Nitrogen occurs in the molecule of the following compounds:

1. amines
2. acylglycerols
3. nucleic acids
4. proteins
5. glucose and fructose
6. peptides
7. alkaloids
8. enzymes

# Primary amines:

1. have the characteristic group -NH-
2. have the characteristic -NH2 group
3. have the characteristic -NH3 group
4. have the characteristic -NH4 group
5. can have a characteristic group attached to the primary carbon atom
6. aliphatic amines produce with nitrous acid alcohols and nitrogen through several intermediates
7. give nitrosamines with nitrous acid
8. may have the -NH2 group attached to the secondary carbon atom

# The compound CH3NH2 is:

1. the primary amine
2. the secondary amine
3. soluble in water
4. a gas
5. methylamine
6. a substance with acidic properties
7. a substance used for the preparation of diazonium salts
8. a substance used for the preparation of nitrosamines

# The compound belongs to:



1. amines
2. cyclic hydrocarbons
3. substances of aromatic character
4. tertiary amines
5. secondary amines
6. primary amines
7. the nitro compound
8. compounds that are part of the molecules of biologically important pigments

# Pyrrole is:

1. a benzene derivative
2. a part of the hemoglobin molecule
3. a part of the chlorophyll molecule
4. an azo dye
5. a part of bile acids
6. a part of bile pigments
7. a part of the purine molecule
8. a porphyrin component

# The compound is:



1. p-phenylenediamine
2. p-aminophenol
3. 1,4-benzenediamine (benzene-1,4-diamine)
4. dimethylamine
5. a primary amine
6. a secondary amine
7. a tertiary amine
8. a component of photographic developers

# Primary amines:

1. are compounds of an alkaline nature
2. are compounds of an acidic nature
3. with acids give ammonium salts
4. with bases produce ammonium salts
5. are derived from ammonia by replacing the hydrogen atom with the monovalent group –R
6. are formed by the hydrogenation of the nitro compounds
7. are strong oxidants
8. are formed by the dehydrogenation of the nitro compounds

# Methyl orange is:

1. colorless at pH = 2
2. a diazonium salt
3. yellow in the basic environment
4. an acid-base indicator
5. an aromatic azo compound
6. a redox indicator
7. the substance present in oranges
8. an azo dye

# Amines:

1. have electrophilic properties
2. have nucleophilic properties
3. have an alkaline character
4. can form ammonium salts
5. have a free electron pair on the nitrogen atom
6. we know only primary amines
7. occuring in nature are only primary
8. are Brönsted bases

# The compound:



1. is found in the urine of mammals
2. is guanidine
3. is used to prepare barbituric acid
4. is carbonic diamide
5. is urea
6. is uric acid
7. is the end product of protein metabolism in humans
8. is a derivative of H2CO3

# The simplest dicarboxylic acid is:

1. acrylic acid
2. adipic acid
3. oxalic acid
4. succinic acid
5. ethanedioic acid
6. acetic acid
7. malonic acid
8. fumaric acid

# The compound HOOC-CH2-COOH is:

1. propanedioic acid
2. propenoic acid
3. aspartic acid
4. glutamic acid
5. propanoic acid
6. maleic acid
7. butyric acid
8. malonic acid

# C6H5-COOH is the:

1. saturated acid
2. aromatic acid
3. aliphatic acid
4. acyclic acid
5. monocarboxylic acid
6. phenolic acid
7. benzoic acid
8. benzylcarboxylic acid

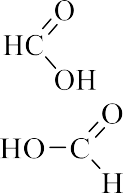
# Citric acid:

1. is a hydroxy acid
2. is a tricarboxylic acid
3. can cause blood coagulation
4. is found in citrus fruits
5. is optically active
6. is 2-hydroxy-1,2,3-butanetrioic acid (2-hydroxybutane-1,2,3-tricarboxylic acid)
7. can be produced by vinegar fermentation
8. binds Ca2+ ions and thus prevents blood clotting

# HOOC-CH2-COOH is:

1. an acid which can be decarboxylated to CH3COOH
2. ketoacid
3. monocarboxylic acid
4. malonic acid
5. methanedioic acid
6. a part of the tricarboxylic acid cycle
7. propanedioic acid
8. the simplest dicarboxylic acid

# Methanoic acid is:

1. a compound with reducing properties
2. a compound with an aldehyde group in the molecule
3. HCOOH
4. HO-COOH e)

f)

1. a substance with bactericidal properties
2. formic acid

# The formula C17H33COOH may be ascribed to:

1. stearic acid
2. oleic acid
3. linoleic acid
4. linolenic acid
5. palmitic acid
6. 9-octadecenoic acid
7. octadecane acid
8. 9,12,15-octatrienoic acid

# Fumaric acid is the acid:

1. which is a part of the Krebs cycle
2. trans-butenedioic
3. saturated, with three carbon atoms
4. saturated, with four carbon atoms
5. unsaturated, with four carbon atoms, the cis-isomer
6. unsaturated, with four carbon atoms, the trans-isomer
7. monocarboxylic acid
8. dicarboxylic acid

# The carboxylic acid is:

1. the stronger, the greater its ionization degree is
2. the stronger, the greater its Ka is
3. the stronger, the greater its pKa is
4. the stronger, the lower its Ka
5. the stronger, the lower its pKa is
6. the stronger, the more concentrated it is
7. stronger with the longer hydrocarbon chain
8. stronger with the higher ionization constant

# Esterification:

1. is the reaction of an alcohol with an aldehyde to form the inner ester
2. is a nucleophilic substitution with an addition-elimination mechanism
3. is an electrophilic addition
4. is the reaction in which an ester is formed, and water is released
5. is shifted in the direction of reactant formation if we remove the formed water
6. is shifted in the direction of product formation if we remove the formed water
7. is the reaction of hydroxides with acids
8. is the reaction of alcohols with inorganic oxoacids or organic carboxylic acids

# The saponification of a long-chain carboxylic acid ester results in the formation of:

1. a free acid
2. an alcohol
3. a long-chain carboxylic acid salt
4. an aldehyde
5. a soap
6. an alkyloxonium salt
7. a compound of the type R-COO-X+ (where X is, e.g. K or Na)
8. a compound of the type R-CO-X+ (where X is, e.g. K or Na)

# Ethanoic acid may be formed:

1. by the ethanol fermentation pathway
2. by the oxidation of acetone
3. by the complete oxidation of ethyl alcohol
4. the decarboxylation of malonic acid
5. the oxidation of acetaldehyde
6. the reduction of ethanol
7. by the oxidation of methanol to the second stage
8. by the reduction of ethanol

# Which of the following statements about citric acid is true:

1. it can be prepared from aspirin
2. it forms the cis-trans isomer
3. it rotates the plane of polarized light
4. it binds Ca2+ cations and thus prevents blood clotting
5. it is not optically active
6. it occurs in the L-configuration
7. it occurs in the D-configuration
8. it is a part of the Krebs cycle

# Optically active acids include:

1. 2-aminopropanoic acid
2. adipic acid
3. oxalic acid
4. citric acid
5. lactic acid
6. malic acid
7. fumaric acid
8. succinic acid

# Lactic acid:

1. is a substitution derivative of carboxylic acid
2. has the formula CH3-CH(OH) –COOH
3. occurs as D (-) in the muscles
4. occurs as L (+) in the muscles
5. is present in sauerkraut (sour cabbage)
6. is optically active
7. has no asymmetric carbon in the molecule
8. is one of the functional derivatives of carboxylic acids

# The addition of 2 molecules of hydrogen to linolenic acid results in the formation of:

1. stearic acid
2. linoleic acid
3. oleic acid
4. palmitic acid
5. palmitoleic acid
6. C17H33COOH
7. C17H35COOH
8. hexadecanoic acid

# Which of the following statements about dicarboxylic acids is true:

1. they are stronger than monocarboxylic acids with the same number of carbon atoms
2. they are weaker than monocarboxylic acids with the same number of carbon atoms
3. their acidity depends on the distance between carboxyl groups in the molecule
4. the acidity of their -COOH groups is mutually canceled
5. all are liquids
6. they are crystalline substances
7. they are, for example, adipic acid and glutaric acid
8. they are, for example, salicylic acid and acetylsalicylic acid

# One mole of malonic acid reacts with (without the rest):

1. 2 mol CsOH
2. 1 mol Ba(OH)2
3. 3 mol LiOH
4. 2 mol Ca(OH)2
5. 1 mol Mg(OH)2
6. 2 mol KOH
7. 3 mol NaOH
8. 1 mol Fe(OH)3

# The opposite of esterification is:

1. hydrogenation
2. hydration
3. hydrolysis
4. condensation
5. dehydrogenation
6. elimination
7. oxidation
8. dehydration

# Which of the following statements about the name of carboxylic acid and its formula is true:

1. HOOC-COOH oxalic acid
2. HOOC-CH2-CH2-COOH succinic acid
3. CH3-CH2-COOH acrylic acid
4. HOOC-CH = CH-COOH butenedioic acid
5. CH2 = CH-COOH adipic acid
6. HOOC-(CH2)3-COOH glutaric acid
7. CH3-CH2-CH2-COOH butyric acid
8. HOOC-CH2-CH (OH)-COOH tartaric acid

# The correct formula for glutaric acid is:

1. HOOC-CH(NH2)-(CH)2-COOH
2. HOOC-(CH2)2-COOH
3. HOOC-(CH2)3-COOH
4. HOOC-(CH2)4-COOH
5. HOOC-(CH2)5-COOH
6. HOOC-(CH2)6-COOH
7. CH3-(CH2)4-COOH
8. CH3-(CH2)6-COOH

# The formula is:



1. aldol
2. ketone
3. hydroxyketone
4. ethanoic acid
5. formic acid
6. carbonic acid
7. formic acid aldehyde
8. methanoic acid

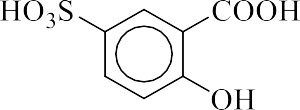
# Salicylic acid has the following structure:



a)

b)



1. C6H5-SO3H
2. HOOC-C6H4-O-CO-CH3 e)

f)



g)



h)



# The compound is an acid which:



1. is found in citrus fruits
2. prevents blood clotting
3. is an intermediate in carbohydrate metabolism (in mammals)
4. is tricarboxylic acid
5. precipitates proteins
6. is a functional derivative of a carboxylic acid
7. is a substitution derivative of carboxylic acid
8. is called citric acid

# The acyclic carboxylic acids with a small number of carbon atoms (C1-C4) are, under standard conditions:

1. in the solid state
2. in the liquid state
3. in the gaseous state
4. in all known states
5. insoluble in water
6. soluble in water
7. colored compounds
8. substances with a pleasant smell and are therefore used for the preparation of perfumes

# Carboxylic acids:

1. are mostly weak acids
2. are mostly strong acids
3. are ampholytes
4. have two equivalent oxygen atoms in the ionized carboxyl group
5. all belong to nonpolar compounds
6. are substances whose water solubility is dependent on the length of the hydrocarbon chain
7. aspartic and glutamic acids belong to hydroxy acids
8. in the anion -COO- have the same distance and character of the bond between two oxygen atoms and the carbon atom

# Carboxylic acids can be prepared:

1. by the oxidation of aldehydes
2. by the complete oxidation of primary alcohols
3. by the complete oxidation of secondary alcohols
4. by the fermentation of saccharides
5. e.g. by the reduction of benzenesulfonic acid
6. by the reduction of aldehydes
7. by the acid hydrolysis of esters
8. by the hydrolysis of carboxylic acid anhydrides

# The reaction of the neutralization of propionic acid with sodium hydroxide is expressed by the equation:

1. CH3-CH2-COOH + NaOH NaOOC-CH2-CH3 + H2O
2. CH3-CH2-COOH + 2 NaOH CH3-CH2-CONa2 + H2O
3. HOOC-CH2-COOH + 2 NaOH NaOOC-CH2-COONa + 2H2O
4. CH3-COOH + NaOH CH3COONa + H2O
5. C2H5-COOH + NaOH C2H5-COONa + H2O
6. CH3-CH2-COOH + NaOH CH3-CH2-CONa + H2O
7. CH3-CH2-COH + NaOH CH3-CH2-COONa + H2
8. esterification

# Saponification is:

1. an enzyme reaction
2. the soap neutralization
3. the soap hydrolysis in alkaline medium
4. formally the opposite of the reaction generating triacylglycerols, while the saponification is carried out in the presence of KOH or NaOH
5. the hydrolysis of simple fats in the presence of NaOH or KOH
6. the reaction used for the soap production
7. a reaction in which an ester forms a salt of a long-chain carboxylic acid
8. a reaction of an ester and water formation

# 1 mol of Ba(OH)2 can be neutralized completely and without residue by:

1. 1 mol of suberic acid
2. 3 mol of benzoic acid
3. 1 mol of phthalic acid
4. 1 mol of citric acid
5. 2 mol of acetic acid
6. 2 mol of succinic acid
7. 1 mol of oxalic acid
8. 0.5 mol of oxalic acid

# Butyric acid has the formula:

1. HOOC-CH2-COOH
2. CH3-CH2-CH2-COOH
3. CH3-CH2-CH2-CH2-CH2-COOH
4. HOOC-(CH2)4-COOH
5. HOOC-(CH2)5-COOH
6. CH3-(CH2)5-COOH
7. HOOC-(CH2)2-CH3
8. HOOC-(CH2)6-COOH

# The simplest unsaturated dicarboxylic acid is:

1. malonic acid
2. fumaric acid
3. maleic acid
4. butenedioic acid
5. succinic acid
6. oleic acid
7. oxalic acid
8. acrylic acid

# By the complete hydrogenation of linolenic acid, we can obtain the acid with the rational formula:

1. C15H29COOH
2. C15H31COOH
3. C17H29COOH
4. C17H31COOH
5. C17H33COOH
6. C17H35COOH
7. C15H33COOH
8. C19H39COOH

# Elimination of 2 molecules of hydrogen from C17H33COOH yields:

1. an acid with three double bonds
2. oleic acid
3. linolenic acid
4. linoleic acid
5. an acid with two double bonds
6. palmitoleic acid
7. octadecenoic acid
8. C17H29COOH

# Carboxylic acid substitution derivatives include:

1. ethers
2. acid anhydrides
3. amino acids
4. halo acids
5. amides
6. esters
7. hydroxy acids
8. acid halides

# Tartaric acid:

1. has one chiral carbon atom
2. has two chiral carbon atoms
3. is a functional carboxylic acid derivative
4. is a substitution derivative of carboxylic acid
5. is optically active
6. forms epimers
7. is the substance from which the Seignett salt is derived
8. is monohydroxy succinic acid

# Acetylsalicylic acid is:

1. salicylic acid ester with acetic acid
2. salicylic acid ester with ethyl alcohol
3. amino acid
4. a functional derivative of acetic acid
5. acetic acid ester
6. aspirine
7. a substance of a basic nature
8. the structural part of barbituric acid

# The compound CH3-CO-CH2-COOH is:

1. pyruvic acid
2. the acid, which may be decarboxylated to acetone
3. oxaloacetic acid
4. acetoacetic acid
5. 3-ketopropanoic acid
6. oxoethane
7. 3-oxobutanoic acid
8. oxosuccinic acid

# The compound may be formed:



1. by the oxidation of pyruvic acid
2. by the reduction of pyruvic acid
3. in glycolysis (under anaerobic conditions) in the organism
4. by the addition of water to succinic acid and subsequent decarboxylation
5. during milk fermentation from carbohydrates
6. under physiological conditions in the gastric juice
7. by the hydrogenation of 2-oxopropanoic acid
8. by the decarboxylation of tartaric acid

# 2-hydroxypropanoic acid:

1. is formed by the oxidation of acetic acid
2. is found in sauerkraut (sour cabbage)
3. is found in sour milk
4. is formed by the oxidation of pyruvic acid
5. is formed by the reduction of 2-oxopropanoic acid
6. is the main product of aerobic carbohydrate degradation
7. is formed during muscle work as a metabolite of saccharides
8. is lactic acid

# Carboxylic acid substitution derivatives include:

1. hydroxy acids
2. salts of acids
3. amides of acids
4. anhydrides of acids
5. oxyacids
6. halo acids
7. halides of acids
8. esters of acids

# Neutral amino acids:

1. have always -OH group in the hydrocarbon chain
2. have one carboxyl group and one -NH2 group
3. have the group =N- instead of -NH2
4. have the -CHO group instead of the -COOH group
5. are, e.g. serine, arginine, lysine
6. are, e.g. glutamic acid, cysteine, histidine
7. are, e.g. glycine, alanine, leucine
8. are, e.g. proline, tyrosine, aspartic acid

# At the isoelectric point neutral amino acids:

1. have only the -COOH group ionized
2. have only -NH2 group ionized
3. have an ionized carboxyl group and an amino group to the ions: -COO- and -NH3+
4. have no ionized characteristic groups and therefore are electroneutral
5. move only to the cathode
6. move only to the anode
7. do not move in a one-way electric field
8. have the structure:



# At the isoelectric point, glycine is in the following structural form:

1. H2N-CH2-COOH
2. H3N+-CH2-COO-
3. HN=CH-COOH
4. H2N-CH2-COO-
5. H3N+-CH2-COOH
6. H3C-CH(NH3+)-COOH
7. H3N+-CH--COOH
8. -OOC-CH2-NH3+

# Glycine at pH = 9 is predominantly in the following structural form:

1. H2N-CH2-COO-
2. H2N-CH2-COOH
3. H3N+-CH2-COOH
4. H3N+-CH2-COO- e)



f) HO-CH2-CH2-O- g)



h)



# Compound has the name:



1. alanine
2. serine
3. threonine
4. cysteine
5. asparagine
6. α-amino-β-hydroxypropionic acid
7. 2-amino-3-hydroxypropanoic acid
8. valine

# The compound is:



1. tyrosine
2. threonine
3. phenylalanine
4. tryptophan
5. histidine
6. 4-hydroxyphenylalanine
7. proline
8. tryptamine

# Glutamic acid:

1. by decarboxylation gives glutamine
2. is 2-aminopentanedioic acid
3. is monoamino monocarboxylic acid
4. is diaminomonocarboxylic acid
5. is monoaminodicarboxylic acid
6. has the formula HOOC-CH2-CH2-CH2-COOH
7. has the formula HOOC-CH2-CH2-CH(NH2)-COOH
8. is an acidic amino acid

# Compound HOOC-CO-CH2-CH2-COOH:

1. is formed in the citrate cycle
2. is called α-oxoglutamic acid
3. is alpha-ketoglutaric acid
4. is glutamic acid
5. is glutaric acid
6. is 2-oxoglutaric acid
7. is 2-oxopentanedioic acid
8. is an intermediate in the Krebs cycle

# Trichloroacetic acid:

1. is used to precipitate proteins in the biological material
2. is used as a blood-clotting agent
3. denatures proteins
4. is the weakest halo carboxylic acid
5. has the formula (CH3COO)3Cl
6. is a strong acid
7. has the formula Cl3C-COOH
8. is a stronger acid than monochloroacetic acid

# Select optically active compounds:

a)



b)



c)



d)



e)



f)



1. cysteine
2. glucose

# Lactic acid may be formed:

1. by adding two hydrogen atoms to pyruvic acid
2. by the hydration of pyruvic acid
3. by the hydrogenation of 2-oxopropanoic acid
4. by the reduction of pyruvic acid
5. by the oxidation of pyruvic acid
6. in the gastric juice under physiological conditions
7. in the gastric juice under pathological conditions
8. in the process of anaerobic glycolysis

# Acetone from acetoacetic acid may be formed:

1. by oxidation
2. by reduction
3. by decarboxylation
4. by dehydrogenation
5. by CO2 elimination
6. by elimination of H2O
7. by hydrogenation
8. by hydration

# The acidic character has the amino acid:

1. 2-aminoglutaric acid
2. 3-hydroxy-2-aminopropanoic acid
3. aspartic acid
4. glutamic acid
5. valine
6. arginine
7. lysine
8. leucine

# Which of the following acids are well soluble in water:

1. formic acid
2. stearic acid
3. linoleic acid
4. acetic acid
5. propionic acid
6. palmitic acid
7. ethanoic acid
8. trichloroacetic acid

# The group is:



1. responsible for its oxidation properties in the formic acid molecule
2. formaldehyde
3. formyl
4. a characteristic group of ketones
5. a characteristic group of aldehydes
6. a characteristic group of carboxylic acids
7. acetyl
8. a group which gives the molecule reducing properties

# Acetyl is:

1. a synonym for acetate
2. the acetic acid residue after removal of the -OH group from the carboxyl group
3. CH3-CO-
4. the acetic acid residue after removal of the hydrogen atom from the carboxylic group
5. acetic anhydride
6. the name for acyl derived from ethanoic acid
7. the name for the acetic acid salt
8. acetate

# Aluminium acetate has the formula:

1. CH3-COAl3
2. (CH3-COO)Al
3. (CH3-COO)2Al3
4. (CH3-COO)3Al
5. (CH3-CO)3Al
6. CH3-COOAl3
7. CH3-COAl
8. (CH3-CO)2Al

# The basic component of kidney stones is:

1. calcium oxaloacetate
2. sodium acetate
3. (COO)2Ca
4. calcium citrate
5. sodium citrate
6. calcium oxalate
7. sodium oxalate
8. calcium salt of oxalic acid

# The soap may be:

1. potassium acetate
2. sodium phenolate
3. sodium arachidate
4. potassium palmitate
5. potassium stearate
6. sodium myristate
7. CH3-(CH2)14-COOK
8. CH3-(CH2)16-CONa

# Carboxylic acid salts may be formed by:

1. the reaction of carboxylic acids with hydroxides
2. replacing the -OH group in the carboxyl group with a metal
3. replacing the hydrogen cation in the carboxyl group with a metal cation or a NH4+
4. carboxylic acids neutralization
5. the acid hydrolysis of esters
6. esterification
7. the reduction of carboxylic acids
8. salting out the carboxylic acids

# The compound containing the following functional group is:



1. ester
2. anhydride
3. hemiacetal
4. acetal
5. ketone
6. hemiketal
7. peroxide
8. a functional derivative of carboxylic acids

# The anhydride can be formed by the release of the water molecule:

1. from one molecule of non- oxyacid and one molecule of oxyacid
2. from two molecules of hemiacetals
3. from one dicarboxylic acid molecule
4. from one monocarboxylic acid molecule
5. from two monocarboxylic acid molecules
6. from two molecules of aldehydes
7. from an inorganic oxyacid
8. from one molecule of amino acid valine

# The acid amide has the general formula:

a)



1. R-COO-NH2
2. R-CO-NH2
3. R-NH-R
4. R-CO-NH-CO-R
5. R-CO-NO2 g)



h) R-COONH

# Aspirin is formed by:

1. the neutralization of salicylic acid
2. the reduction of the carboxyl group of salicylic acid
3. the esterification of the carboxyl group of acetic acid with salicylic acid
4. the reaction of acetic acid and pyridine
5. the reaction of salicylic acid with acetyl chloride
6. the esterification of salicylic acid with ethanol
7. the esterification of the -COOH group in salicylic acid
8. the esterification of phenolic hydroxyl in salicylic acid with acetic acid

# The compound is:

1. aspirin
2. benzoylacetate
3. acetylsalicylic acid
4. benzoylacetyl ether
5. salicylic acid
6. 2-hydroxybenzoic acid ester with ethanol
7. the o-hydroxybenzoic acid ester with acetic acid chloride
8. the drug against fever, pain and cold

# Reaction of ethanoic acid with methanol gives:

1. CH3-CO-O-CH2-CH3
2. CH3-CO-O-CH3
3. CH3-O-CO-CH2-CH3
4. CH3-O-CO-CH3
5. ethyl ester of formic acid
6. methyl ester of ethanoic acid
7. methyl ester of acetic acid
8. methyl acetate

# The formation of the compound CH3-O-CO-CH2-CH3 involves:

1. methanol and ethanoic acid
2. C2H5OH and CH3COOH
3. methanol and propanoic acid
4. propanol and acetic acid
5. ethanol and ethanoic acid
6. ethanol and propionic acid
7. propionic acid and methanol
8. CH3-CH2-COCl and CH3OH

# The internal anhydride is formed from the following acid:

1. propanoic acid
2. butyric acid
3. succinic acid
4. phthalic acid
5. adipic acid
6. stearic acid
7. salicylic acid
8. benzoic acid

# The compound is:



1. ethyl phosphine
2. ethyl phosphate
3. glycerophosphate
4. ethyl phosphoether
5. generally alkyl phosphate
6. propyl phosphate
7. methyl phosphate
8. ester of H3PO4 with ethanol

# Urea is:

1. uric acid diamide
2. carbonic acid diamide
3. uric acid salt
4. a compound of formula CO(NH2)2
5. a compound of formula HCOONH2
6. a substance which is used to manufacture certain drugs
7. a compound from which we can derive iminourea
8. the major end product of protein metabolism in humans

# Carbonic acid:

1. is formed as an intermediate in the oxidation of formic acid
2. decomposes to CO2 and H2
3. is a monohydric acid
4. is a strong inorganic acid
5. is a strong organic acid
6. forms derivatives that can be included to organic compounds
7. is a compound from which phosgene can be derived
8. is a substance from which urea can be derived

# The structure -OOC-CH(OH) -CH2-COO- belongs to:

1. malonate
2. maleinate
3. malate
4. butyrate
5. malonyl
6. glutaryl
7. succinyl
8. oxalyl

# Which of the following compounds can be included to the functional derivatives of carboxylic acids:

1. acetic anhydride
2. alanine
3. calcium acetate
4. benzoyl chloride
5. ethyl acetate
6. acetyl chloride
7. pyruvic acid
8. acetamide

# Acetyl is:

a)



b)



c)



1. CH3-COOH
2. a group formed from acetic acid after the -OH group is removed
3. a group formed after the hydrogen atom is cleaved from the carboxyl group of ethanoic acid
4. the synonym for acyl
5. an acetic acid abbreviation

# Calcium oxalate has the formula:

1. CaOOC-CH2-COOCa
2. (OOC-CH2-COO)Ca
3. (COO)2Ca
4. CaOOC-COOCa
5. HOOC-COOCa
6. (CO)2Ca2
7. Ca-OC-CO-Ca
8. Ca-OC-COOH

# Ferric acetate has the formula:

1. (CH3COO)2Fe3
2. (CH3COO)3Fe2
3. (CH3CO)3Fe
4. (CH3COO)3Fe
5. CH3COOFe
6. CH3COOFe3
7. CH3COFe3
8. (CH3COO)2Fe

# Soap can be:

1. potassium valerate
2. sodium palmitate
3. potassium stearate
4. calcium phthalate
5. potassium salt of a long-chain carboxylic acid
6. C17H35COONa
7. C15H31COOK
8. potassium benzoate

# The carboxylic acid anhydride can be formed by cleaving the water molecule from:

1. 2 molecules of ethanol
2. 1 adipic acid molecule
3. 1 molecule of acetic acid
4. 1 molecule of propionic acid and 1 molecule of acetic acid
5. 2 molecules of acetaldehyde
6. 1 glutaric acid molecule
7. 1 lactic acid molecule
8. 1 phthalic acid molecule

# The compound



1. acetic anhydride
2. anhydride of acetic acid
3. hemiacetal
4. ketal
5. anhydride
6. aldol
7. ester
8. oxoether

# Acetic acid amide is:

a)



1. CH3-CO-NH2
2. a functional derivative of ethanoic acid
3. CH3-COO-NH2 e)



1. CH3-CO-NO2
2. glycine
3. CH3-CH2-CO-NH2

# Hydrolysis of the compound results in the formation of:



1. ethanol
2. acetic acid
3. propanoic acid
4. methanol
5. ethanoic acid
6. methanoic acid
7. acetyl chloride
8. propionic acid

# For the formation of the compound CH3-O-CO-C6H5, the following compounds may be involved:

1. methyl alcohol
2. ethanol
3. methanol
4. hexanol
5. benzoyl chloride
6. methanoic acid
7. benzoic acid
8. benzene

# The compound CH3-O-CO-CH3 is generated from:

1. methane and acetic acid
2. ethanol and ethanoic acid
3. methanol and acetic acid
4. acetic acid and ethyl alcohol
5. ethanoic acid and methyl alcohol
6. acetyl chloride and methanol
7. acetic anhydride and methanol
8. acetic anhydride and ethanol

# Trihydrogen phosphoric acid ethyl ester has the formula:



a)

1. CH3-CH2-O-PO3H
2. CH3-CH2-O-PO3H2
3. CH3-CO-O-PO3H2
4. CH3-CH2-O-PO4H2
5. CH3-CO-O-PO4H2
6. CH3-O-PO3H2
7. CH3-CH2-PO3H2

# Which of the following statements about simple lipids is true:

1. they contain glucose bound by the ester bond
2. they do not contain an ester bond
3. they have hydrophobic properties
4. they are esters of long-chain carboxylic acids and glycerol
5. they can contain the rest of H3PO4
6. they are soluble in water
7. they contain the bond -O-CO-
8. they are received by food in a form of triacylglycerols

# Palmitic acid:

1. is a compound of formula CH3-(CH2)15-COOH
2. is a compound of formula CH3-(CH2)14-COOH
3. is a compound of formula CH3-(CH2)16-COOH
4. is hexadecanoic acid
5. is a saturated long-chain carboxylic acid
6. as well as stearic acid, both have 16 carbons
7. is an 18 carbon carboxylic acid
8. is a part of triacylglycerols

# Two or more double bonds are present in:

1. propanedioic acid
2. CH3-(CH2)16-COOH
3. oleic acid
4. palmitic acid
5. hexadecanoic acid
6. linoleic acid
7. stearic acid
8. arachidonic acid

# Acylglycerols as an alcohol part can contain:

1. ribitol
2. different alcohols
3. 1,2,3-propanetriol (propane-1,2,3-triol)
4. palmitic acid
5. long-chain monohydric alcohols
6. trihydric alcohol
7. ethanol
8. tertiary alcohol

# Ester bond:

1. does not undergo the hydrolysis by strong acids and bases
2. is formed between amino acids in proteins
3. occurs in cholesterol esters
4. is formed by the reaction of an alcohol with a carboxylic acid
5. occurs in starch
6. occurs in cellulose
7. occurs in acylglycerols
8. of lipids can be cleaved in the gastrointestinal tract by lipase

# Compound CH3-(CH2)16-COONa is:

1. a compound which belongs to sodium soaps
2. a product of alkaline hydrolysis of neutral fats
3. stearic acid
4. sodium palmitate
5. sodium stearate
6. sodium salt of stearyl alcohol
7. one of the products which are formed by the reaction of NaOH with triacylglycerols
8. a substance which is formed in the process of rancidification of fats

# To saturated long-chain fatty acids belong:

1. acids with a general formula CnH2n+2
2. stearic acid
3. linoleic acid
4. arachidic acid
5. acids essential for human
6. hexadecanoic acid
7. dehydroascorbic acid
8. linolenic acid

# Acylglycerols in their molecule can contain components:

1. bound by the phosphoester bond
2. saturated fatty acids and glycerol
3. unsaturated fatty acids and glycerol
4. glucose
5. 1,2,3-propanetriol (propane-1,2,3-triol)
6. stearyl alcohol
7. bound by the ester bond
8. glycerol

# Biological functions of lipids are:

1. production of ATP after the oxidation of carboxylic acids released from triacylglycerols
2. they are solvents for vitamins of B group
3. they are important source of energy
4. they are solvents for biologically important nonpolar compounds
5. they are solvents for biologically important polar compounds
6. they are a reserve of energy for the organism
7. they are part of nucleic acids
8. they are part of biological membranes

# For the biological value of plant oils is responsible:

1. the type of fatty acids
2. the content of glycerol
3. the content of unsaturated fatty acids
4. the content of essential amino acids
5. the presence of triple bonds in carboxylic acids
6. the presence of double bonds in carboxylic acids
7. the alcohol component
8. the presence of essential fatty acids

# To complex lipids belong:

1. phospholipids
2. mixed triacylglycerols
3. waxes
4. those lipids which are the main part of adipose tissue
5. lecithins
6. choline
7. those which contain e.g. also ethanolamine
8. those which contain e.g. also serine

# Triacylglycerols:

1. can be simple and also mixed acylglycerols
2. contain three long-chain carboxylic acids bound with a tertiary alcohol
3. contain bound saturated and unsaturated long-chain carboxylic acids
4. do not contain choline
5. contain as an alcohol part a trihydric alcohol
6. are complex lipids
7. are hydrophilic
8. do not contain phosphoric acid

# Important nonpolar substances for human are:

1. also components of biological membranes
2. simple triacylglycerols
3. vitamin E
4. vitamin C
5. vitamins of B group
6. esters of cholesterol
7. vitamin A
8. choline

# Which of the following compounds have hydrophobic properties:

1. compounds not soluble in water but soluble in nonpolar solvents
2. vitamins C and B1
3. e.g. fats which can be stored in the adipose tissue
4. esters of cholesterol
5. nonpolar compounds
6. mixed triacylglycerols
7. waxes
8. from lipids only phospholipids

# Essential long-chain carboxylic acids are:

1. all fatty acids with the number of carbon atoms 18
2. unsaturated fatty acids with two or more unsaturated bonds
3. palmitic and stearic acids
4. glyceric acid
5. glutamic acid
6. e.g. linolenic acid
7. e.g. linoleic acid
8. all acids with the number of carbon atoms higher than 16

# Compound CH3-(CH2)16-COONa:

1. has a polar and a nonpolar part of the molecule
2. has no emulsifying properties
3. is formed mainly by the cleavage of acylglycerols in the gastrointestinal tract
4. is sodium stearate
5. is a functional derivative of carboxylic acid
6. is sodium alcoholate
7. is a substitution derivative of carboxylic acid
8. does not contain an ester bond

# Important sources of energy for a man are:

1. lipids
2. steroid substances e.g. cholesterol
3. nucleic acid
4. hormones
5. saccharides
6. triacylglycerols
7. polysaccharides
8. nucleotides e.g. AMP

# Complex lipids are compounds:

1. with their components bound only by the carboxy ester bond
2. which occur also in brain, spinal cord, myocardium
3. which have a polar and a non polar part of the molecule
4. which are important components of cell membranes
5. including also phospholipids
6. including also mixed triacylglycerols
7. including also glycolipids
8. which can contain the rest of HCl

# In a polar part of complex lipids the following compound can be bound:

1. phosphoric acid
2. a carbon chain of a fatty acid
3. choline
4. ethanolamine
5. serine
6. compound HO-CH2-CH2-NH2
7. adenine
8. a compound of formula HO-CH2-CH2-N+(CH3)3

# In the nonpolar part of complex lipids the following compound is bound:

1. HO-CH2-CH2-NH2
2. a hydrocarbon chain of a long-chain carboxylic acid
3. e.g. a hydrocarbon chain of palmitic acid
4. choline
5. phosphate group
6. ethanol
7. serine
8. sodium stearate

# In simple lipids there are not bound compounds:

1. by a phosphoester bond
2. phosphoric acid
3. serine
4. glycerol
5. glucose
6. choline
7. saturated fatty acids
8. unsaturated fatty acids

# Select compounds which are not present in complex lipids:

1. CH2(OH)-CH(NH2)-COOH
2. phosphoric acid
3. glycerol
4. dicarboxylic acids
5. choline
6. a nitrogen base guanine
7. saccharides
8. lipase

# Which of the following lipids belong to glycolipids:

1. lecithins
2. lipids containing galactose
3. cerebrosides
4. lipids containing glycogen
5. all phospholipids
6. all lipids containing glycerol
7. waxes
8. lipids containing glucose

# Phospholipids:

1. do not contain threonine in the molecule
2. can contain glycerol in the molecule
3. can contain three rests of H3PO4 (e.g. 3-phosphoglyceric acid)
4. can contain serine in the molecule
5. contain also the phosphoester bond
6. have glucose bound by the phosphoester bond
7. contain cholesterol
8. unlike triacylglycerols they also have a polar part in the molecule

# The essential carboxylic acids:

1. occur in triacylglycerols
2. are unsaturated fatty acids, e.g. with two triple bonds
3. are a measure of biological value of plant oils
4. can be synthesized by the organism
5. are formed in the organism by transamination
6. occur in phospholipids
7. the organism can synthesize from non essential long-chain carboxylic acids by decarboxylation
8. are e.g. linoleic and linolenic acids

# Terpenes include:

1. compounds that have isoprene units in their molecule
2. natural caoutchouc
3. intermediate of glycogen synthesis
4. tryptophan
5. carotenoids
6. beta-carotene
7. morphine
8. nicotinamide adenine dinucleotide

# The structure :



1. is a unit from which by the addition of water steroids are formed
2. is present in terpenes
3. is derived from 2-chloro-1,3-butadiene (2-chlorobuta-1,3-diene)
4. is 2-pentene (pent-2-ene)
5. is an isoprene unit
6. is part of the natural caoutchouc (rubber)
7. is present in carotenoids
8. is 2-methyl-1,3-butadiene (2-methylbuta-1,3-diene)

# Provitamin A:

1. belongs to terpenes
2. is beta-carotene
3. occurs e.g. in carrot
4. contains isoprene units
5. in the organism is changed to vitamin of a steroid nature
6. occurs in the plant food
7. is tocopherol
8. is a compound from which retinol can be formed in the organism

# Ergocalciferol:

1. is produced by the irradiation of the substance of a steroid character
2. is vitamin D2
3. affects the absorption of Ca2+ from the digestive tract into the blood
4. is esterified cholesterol
5. affects the metabolism of calcium
6. is a main hormone of adrenal cortex
7. belongs to hormones of adrenal medulla
8. is produced by the irradiation of calcitonin

# Which of the following substances belong to sterols:

1. a compound which gives acylcholesterol by the esterification with a fatty acid
2. retinol
3. thiazole
4. cholesterol
5. hormone adrenaline
6. a compound which gives vitamin D2 after the UV irradiation
7. vitamin A
8. ergosterol

# Which of the functional groups in cholesterol might be esterified:

1. the carboxyl group
2. the hydroxyl group
3. the hydroxyl as well as carboxyl groups
4. cholesterol has no suitable group for the esterification so it can occur only in a free form
5. the oxo group
6. a group in the cholesterol side chain
7. the -OH group
8. the -COOH group

# Bile acids are required:

1. during absorption of fats
2. for the production of steroid hormones
3. for the production of ergocalciferol
4. for the synthesis of vitamin A
5. during the emulsification and the subsequent digestion of triacylglycerols in the digestive tract
6. during the hydrolytic digestion of starch
7. during the hydrolytic digestion of proteins
8. during the hydrolytic digestion of fats taken by food

# Ergocalciferol:

1. is esterified cholesterol
2. is vitamin D2
3. belongs to bile acids
4. is formed directly from cholesterol by the UV irradiation
5. is required for the absorption of calcium
6. is formed in pancreas
7. is alfa-tocopherol
8. is important for the metabolism of calcium

# Steroid compounds include:

1. bile acids
2. hormones of adrenal cortex
3. some essential amino acids
4. substances derived from cyclopentanoperhydrophenanthrene
5. corticoids
6. sex hormones
7. hormones of adrenal medulla
8. hormones of pancreas

# Steroid hormones include:

1. acylcholesterols
2. hormones of adrenal medulla
3. hormones of adrenal cortex
4. male sex hormones
5. insulin and glucagon
6. esters of cholesterol
7. corticoids
8. cholesterol

# Compound with the formula :

1. contains carbon and oxygen as heteroatoms
2. is a heterocyclic compound
3. is a six-membered heterocyclic compound with oxygen
4. is furan
5. is classified as a five-membered heterocycle
6. is formed by the reduction of fumaric acid
7. is one of the heterocyclic rings in the thiazole
8. contains a saturated heterocyclic ring

# Heterocyclic compounds or their derivatives include:

1. a flavin nucleotide component
2. bile pigments
3. phenylalanine
4. pyrrole
5. hem
6. bile acids
7. pyridine
8. nicotinamide adenine dinucleotide

# A molecule of hemoglobin contains:

1. magnesium as the central atom
2. iron as a heteroatom
3. Fe2+
4. Fe3+ in a situation where it carries oxygen
5. a conjugated system of four pyrrole cores
6. four indoles
7. cyclopentanoperhydrophenanthrene core
8. a heterocyclic part

# Chlorophyll:

1. is a tetrapyrrole pigment
2. is a green leaf pigment
3. contains cobalt
4. contains iron as the central atom
5. contains magnesium
6. is formed in the human organism
7. contains a conjugated system of four pyrrole cores
8. is a steroid

# Pyrrole can be found in biologically important substances such as:

1. blood oxygen-carrying pigment
2. cholesterol
3. bilirubin
4. vitamin D
5. bile acids
6. chlorophyll
7. vitamin B12
8. myoglobin

# Nicotinamide:

1. has two heterocyclic rings and is classified as alkaloid
2. is a functional derivative of nicotinic acid
3. is derived from pyridine
4. is a substitution nicotinic acid derivative
5. is derived from pyrimidine
6. is a coenzyme of transamination reactions
7. contains one heteroatom
8. is a part of NAD+

# Heterocyclic compounds:

1. can be both cyclic and aliphatic
2. are not found in higher organisms
3. have important functions in humans as well
4. are e.g. pyrimidine derivatives
5. are found in cell nuclei
6. are not part of DNA or RNA
7. are also found in proteins
8. are a part of each amino acid

# An important pyridine derivative is:

1. cytosine
2. nicotinic acid amide
3. one NAD+ component
4. thymine
5. nicotinic acid
6. vitamin B1
7. vitamin PP
8. vitamin H

# Which amino acids contain a heterocyclic ring in their molecule:

1. ornithine
2. uric acid
3. tryptophan
4. alanine
5. histamine
6. arginine
7. histidine
8. phenylalanine

# Indicate, which of the following compounds have an aromatic character:

1. pyridine
2. benzene
3. thiophene
4. ethyl ether
5. phenylalanine
6. alanine
7. tyrosine
8. cyclohexane

# Pyridine:

1. has basic properties
2. has acidic properties



1. is a compound with formula
2. has two heteroatoms in the molecule
3. has two heteroatoms of nitrogen
4. has nitrogen as the heteroatom
5. has derivatives cysteine and thymine which are a part of the DNA molecule
6. its major derivative is nicotinamide

# Which of the following statements about bile pigments is true:

1. they include cholic acid
2. they are formed by the degradation of hemoglobin
3. they ensure the emulsification of fats received by food
4. they include bilirubin
5. they are produced by the degradation of cholesterol
6. their building unit belongs to heteroarenes
7. they help fat absorption
8. they contain a tetrapyrrole structure

# Select the imidazole formula:

a)



b)



c)



d)



e)



f) CH3-N=N-CH3 g)



h)



# Nitrogen bases derived from pyrimidine are:

1. also part of RNA
2. cytosine
3. nicotinic acid
4. guanine and guanosine
5. tetrapyrroles
6. a nitrogen base formed by the methylation of uracil
7. found in proteins
8. uracil

# Thymine is a compound derived from:

1. uracil by the oxidation
2. tetrapyrroles
3. a heterocyclic compound containing one nitrogen heteroatom
4. purine by methylation
5. a heterocyclic compound containing two different heteroatoms
6. a six-membered heterocyclic compound containing two heteroatoms of nitrogen
7. pyrimidine
8. cytosine directly by methylation

# Cytosine is a molecule derived from:

1. pyridine
2. purine
3. pyrrole
4. a six-membered heterocyclic compound
5. pyrimidine
6. uracil by methylation
7. tetrapyrroles
8. a heterocyclic compound with two heteroatoms

# Which alkaloid is used to stimulate the central nervous system:

1. atropine
2. nicotinamide
3. theobromine
4. caffeine
5. morphine
6. theophylline
7. an alkaloid classified as analeptic
8. codeine

# The pyrimidine nitrogen bases do not include:

1. a six-membered heterocyclic compound with one oxygen heteroatom
2. thymine
3. cytosine
4. guanine
5. caffeine
6. nicotinamide
7. uracil
8. 5-methyluracil

# The heterocyclic compounds with fused heterocycles include:

1. uric acid
2. pyridine
3. cytosine
4. adenine
5. theobromine
6. purine
7. uric acid and urea
8. guanine

# 6-aminopurine is:

1. a substance that the body cannot synthesize
2. guanine
3. adenine
4. a compound which contains the same heterocycle as theophylline
5. a part of both DNA and RNA
6. caffeine
7. a part of pyrimidine
8. a heterocyclic compound

# Pyrimidine and imidazole rings can be found in the structure of:

1. purines
2. amino acids such as tryptophan and proline
3. imidazole
4. 6-aminopurine and together contain 2 heteroatoms of nitrogen
5. adenine
6. thymine and adenine
7. guanidine
8. nicotinamide

# The compound containing components such as cytosine, ribose and phosphoric acid:

1. is a nucleoside
2. is a nucleotide found in DNA but not in RNA
3. is a monomer that is a building block of DNA
4. is a triplet
5. forms a deoxynucleotide
6. as a nucleotide is a building block of RNA
7. contains N-glycosidic and ester bond in its molecule
8. in mRNA is complementary to guanine deoxynucleotide present in DNA

# Among the nucleoside triphosphate components we can find the following bond:

1. macroergic bond
2. ester bond
3. O-glycosidic bond
4. N-glycosidic bond
5. covalent bond
6. the bond between nitrogen base and ribose
7. the bond between ribose and H3PO4
8. hydrogen bond between two bases

# In ATP trihydrogen phosphoric acid is bound:

1. to ribose via ester bond
2. by the N-glycosidic bond
3. to another phosphoric acid molecule via macroergic bond
4. by an ionic bond
5. to ribose
6. with an additional phosphoric acid molecule via anhydride bond
7. to deoxyribose
8. by a covalent bond

# Guanine is a heterocyclic compound:

1. that is classified as alkaloid with purine cycle
2. found in DNA but not in RNA
3. only with a pyrimidine ring
4. with a purine ring
5. catabolized to uric acid in human
6. where -NH2 group is bound to nitrogen at the sixth position
7. containing 4 heteroatoms of nitrogen
8. with two fused heterocycles

# The final metabolic product of purine compounds in human is:

1. urea and CO2
2. a substance resulting from their complete reduction
3. aminopurine
4. uric acid
5. carboxypurine
6. 2,6,8-trihydroxypurine
7. the product of deamination and oxidation of purine substances
8. ammonia and CO2

# In human the uric acid is the final metabolic product:

1. of pyrimidine compounds and contains three -COOH groups
2. of purine compounds and contains three -OH groups
3. and can form tautomeric forms
4. of urea
5. of proteins
6. of adenine nucleotides
7. of uridine nucleotides
8. of guanine nucleotides

# What types of nucleotides are found in DNA:

1. ones that contain nicotinamide and deoxypentose as a carbohydrate component
2. ones that contain uracil and deoxyribose as a carbohydrate component
3. ones that contain cytosine
4. ones that contain thymine
5. ones that are derived from pyridine
6. ones that are derived from purine
7. ones that have ribose as a carbohydrate component
8. ones that have deoxyaldopentose as a carbohydrate component

# What types of nucleotides are found in rRNA:

1. ones that contain 5-methyluracil and ribose as a carbohydrate component
2. ones that contain thymine and deoxyribose as a carbohydrate component
3. ones that contain guanidine and aldopentose as a carbohydrate component
4. ones that contain uracil and ribose as a carbohydrate component
5. ones that contain cysteine
6. ones that are derived from purine
7. ones that contain cytosine
8. ones that are derived from pyridine

# Which of the following statements about deoxyribonucleic acids is true:

1. they are carriers of a genetic information
2. they are present in chromosomes
3. they are formed by the transcription from the protein structure
4. they are mainly found in the cell nucleus
5. their primary structure consists of nucleotides containing monosaccharide deoxyribose
6. their primary structure is transcribed into RNA on ribosomes
7. they are classified as biopolymers
8. they contain ribose as a carbohydrate component

# We can distinguish RNA and DNA:

1. by the carbohydrate component
2. RNA contains thymine and DNA contains uracil
3. by their function in a cell
4. by the presence of different types of pyrimidine nucleotides
5. by the presence of the different types of basic purine nucleotides
6. by the site of their production in cells
7. by the type of nucleotides
8. by the presence of phosphoric acid

# RNA mainly contains following nitrogen bases:

1. methyluracil
2. two of which are classified as pyridine bases
3. uracil
4. guanine
5. 6-aminopurine
6. pyridine
7. that are classified as purines and pyrimidines
8. dioxopyrimidine

# In nucleic acids following compounds can be found:

1. H3PO4 bound to deoxyribose
2. aldohexoses
3. ketohexoses
4. ketopentoses
5. deoxymonosaccharides derived from pentoses and hexoses
6. riboses
7. aldopentoses
8. purines and pyridines

# Nucleotide is composed of:

1. nucleoside and ribose
2. two components: a nitrogen base and pentose
3. a nitrogen base, pentose and phosphoric acid and it is a building block of nucleic acids
4. guanidine, H3PO4 and ribose
5. a pyridine base, pentose and H3PO4
6. a nitrogen base and pentose linked via H3PO4
7. three components linked via N-glycosidic and phosphoester bonds
8. nucleoside and phosphoric acid

# Polynucleotide:

1. consists of basic units - nucleosides
2. can contain up to millions of basic units, nucleotides
3. consists of the basic units in which a nitrogen base, aldopentose and phosphoric acid are bound
4. consists of basic units - nucleotides
5. is formed on ribosomes
6. contains peptide bonds
7. contains phosphodiester bonds
8. does not contain an amide bond

# Polynucleotide:

1. is formed in the cell nucleus
2. is composed of nucleotides bound by the phosphodiester bond
3. contains purine and pyridine bases, aldopentose and phosphoric acid
4. forms the basis of the DNA structure
5. forms the basis of the mRNA structure
6. is formed from the corresponding nucleoside triphosphates
7. contains deoxyglucose
8. also contains the nitrogen base cysteine

# The double-stranded DNA helix (the secondary DNA structure) is stabilized by:

1. the type of bond that is formed between two electronegative elements, one of which must contain hydrogen
2. hydrogen bonds between adenine and uracil
3. by the same bonds as the double-stranded mRNA
4. by hydrogen bonds between adenine and thymine
5. N-glycosidic bonds
6. by the bond between codon and anticodon
7. peptide bonds
8. hydrogen bonds between complementary bases

# The hydrogen bonds in the DNA molecule are formed between:

1. pyrimidine bases
2. purine bases and ribose
3. two strands of DNA and stabilize its secondary structure
4. purine bases
5. cysteine and guanine
6. adenine and uracil
7. adenine and thymine in one polynucleotide chain
8. adenine and thymine of two anti-parallel DNA strands

# Which of the following statements about DNA and RNA is true:

1. in DNA uracil is a characteristic form of pyrimidine nitrogen bases and in RNA it is thymine
2. they differ in the carbohydrate component
3. they differ in the acidic component
4. they differ in the types of pyrimidine bases
5. the place of their biological effect is in the nucleus
6. they differ in the content of aldose and ketose
7. they differ in the function in the transmission of genetic information
8. they differ in the place of their biological effect

# In DNA complementary nitrogen bases are:

1. identical to those in RNA
2. thymine and guanine
3. one derived from purine and the other one from pyrimidine
4. cytosine and guanine
5. uracil and adenine
6. adenine and 5-methyluracil
7. the ones derived from purine
8. the ones bonded by hydrogen bonds

# Anticodon is:

1. a characteristic region of the tRNA molecule composed of three nucleotides
2. a characteristic region of the tRNA molecule composed of three nucleosides
3. a place where amino acid can bind to rRNA
4. a sequence of three nucleotides in DNA
5. complementary to the codon in mRNA
6. a place in tRNA and this region is the same for all tRNAs
7. is located in tRNA and is specific for the given amino acid
8. is located in tRNA and its tripled determines the order of three amino acids

# Proteosynthesis is when:

1. the replication occurs
2. proteins are formed
3. proteins are produced directly in the transcription
4. the translation occurs
5. mRNA is formed
6. the conversion of genetic information from mRNA is provided during formation of a peptide chain
7. proteins in the cell nucleus are formed from DNA
8. proteins are formed on ribosomes in the presence of mRNA and tRNA

# Ribosomal RNA is formed:

1. in the nucleus during translation from nucleoside triphosphates
2. on ribosomes
3. in the cytoplasm
4. by the transcription of a particular DNA region
5. by the transcription from mRNA on ribosomes
6. from amino acids
7. from deoxynucleoside triphosphate substrates
8. in the nucleus and forms part of the cellular structures where the proteosynthesis occurs

# Which properties of the DNA molecule are important in the transmission of genetic information in human:

1. the existence of a right-handed double-helix DNA and the possibility of its duplication in the reproduction
2. complementarity of the nitrogen bases
3. the possibility of translation from DNA to mRNA
4. the strength of the molecule due to the content of peptide bonds
5. the possibility of reduplication of DNA molecules during the cell division
6. a simple polynucleotide sequence of mRNA
7. complementarity of amino acids
8. the possibility of transmission of information from DNA to the primary protein structure via mRNA

# The information about the amino acid sequence of the protein chain is encoded:

1. in a sequence of deoxyribonucleotides in DNA
2. in a sequence of nucleotides in tRNA
3. in the primary DNA structure
4. in the primary protein structure
5. in the DNA in such a way that one nucleotide determines one amino acid
6. in the DNA in such a way that after the transcription proteins are produced in the translation process
7. in the DNA molecule in such a way that three nucleotides encode one amino acid
8. in a structure of ribosomal RNA

# The general formula C6H12O6 represents the following compound:

1. glucose
2. arabinose
3. glucuronic acid
4. mannose
5. ribose
6. aldohexose
7. ketohexose
8. galactose

# Oxidation of substance “X” yields glucuronic acid. Which of the following statements about the substance „X“ is true:

1. it is a hexose
2. it is a reducing monosaccharide
3. it is a monosaccharide which is in reaction reduced on C-1
4. it is a substance with a carboxylic group
5. it is fructose, which is oxidized on C-6
6. it is a monosaccharide which participates on synthesis of cellulose
7. it is a disaccharide consisting of glucose and fructose
8. it is a substance with an aldehyde group

# Glucose is:

1. a compound soluble in polar solvents
2. polyhydroxyaldehyde
3. a physiological component of blood plasma
4. a possible substrate for synthesis of glycosides
5. aldopentose
6. a physiological component of urine
7. an electrolyte
8. a compound metabolized by yeasts to ethanol and carbon dioxide

# Which of the following compounds belong to monosaccharides:

1. glyceraldehyde
2. ribose
3. dihydroxyacetone
4. saccharose
5. hemicellulose
6. mannose
7. pentose
8. fructose

# Glyceraldehyde:

1. has alkaline properties
2. contains one asymmetric carbon atom
3. contains three asymmetric carbon atoms
4. has two cis-trans isomers
5. has two optical isomers
6. is a reducing compound
7. is naturally present in a free form
8. its ester with orthophosphoric acid plays role in metabolism of saccharides in humans

# Aldopentoses can form:

1. only two optical isomers
2. glycosides
3. phosphate esters
4. only three optical isomers
5. biologically important compounds
6. 16 optical isomers
7. nucleosides
8. polysaccharides in plants

# Deoxyribose is:

1. a reducing monosaccharide
2. a structural component of RNA molecule
3. a structural component of DNA molecule
4. hexose
5. a component of UTP molecule
6. a component of dATP molecule
7. a component of thymine molecule
8. a component of DNA molecules in mitochondria

# Cyclic form of monosaccharides is:

1. ester
2. acetal
3. hemiacetal
4. part of cyclopentanoperhydrophenanthrene
5. diester
6. glycoside
7. water-insoluble
8. internal hemiacetal

# Which of the following substances can participate in the formation of hemiacetals:

1. grape sugar
2. acetaldehyde
3. ethanol
4. glutaric acid
5. aspartic acid
6. acetic acid
7. adenine
8. galactose

# The same spatial orientation of hemiacetal hydroxyl group and hydroxyl group on the asymmetric carbon atom which is farthest from anomeric carbon atom results in the formation of:

1. α-D-glucopyranose
2. β-D-glucopyranose
3. α-L-glucopyranose
4. DL-glucose
5. L-lactic acid
6. cellulose
7. β-L-glucopyranose
8. glucuronic acid

# Which of the following statements about monosaccharides and their optical activity is true:

1. the simplest optically active monosaccharide is glyceraldehyde
2. ketopentoses have four stereoisomers
3. optical activity of monosaccharides is related to their important biological properties
4. free L-glucose is present in the blood of mammals
5. all monosaccharides, which are structural components of living matter, are optically active substances
6. the enzymes of alcohol fermentation disrupt only L-forms of saccharides
7. monosaccharides which are present in living matter, rotate the plane of polarized light only in an anti-clockwise direction
8. glyceraldehyde can exists in four stereoisomers

# Monosaccharides participate in:

1. the formation of glycoside linkages
2. condensation reactions
3. oxidoreduction reactions
4. proteolytic reactions
5. polycondensation reactions
6. synthesis of polysaccharides
7. peptide bond formation
8. synthesis of glycoproteins

# Glucitol is formed by:

1. the oxidation of glycerol
2. the esterification of glucose
3. the complete reduction of gluconic acid
4. the oxidation of glucose
5. the reduction of glucose
6. the phosphorylation of gluconic acid
7. the condensation of two glucose molecules
8. the reduction of aldopentose

# Mannitol is:

1. polyhydroxyketone
2. aldose
3. polyhydroxy compound
4. water soluble compound
5. a product of starch hydrolysis
6. a product of reduction of galactonic acid
7. a product of mannose oxidation
8. a product of nucleoside hydrolysis

# Formula C6H12O6 may belongs to:

1. glucose
2. glucitol
3. aldonic acid
4. ketohexose
5. the product of glucitol oxidation (into the first step)
6. the product of lactose hydrolysis
7. the product of DNA hydrolysis
8. the product of cellulose hydrolysis

# Formation of glycosidic bond is:

1. a reaction of two hemiacetal hydroxyl groups of two monosaccharides during the synthesis of disaccharide
2. the hydrolytic reaction
3. the condensation reaction
4. the esterification reaction
5. the reaction of connection of two monosaccharides during the synthesis of cellulose
6. the reaction of hemiacetal hydroxyl group and alcoholic hydroxyl group
7. the reaction of alcoholic hydroxyl group and OH-group of orthophosphoric acid
8. the reaction catalyzed by oxidoreductase

# Glycosides may be synthesized:

1. in polycondensation reactions
2. in the reaction of two saccharides
3. in the reaction of cyclic form of a monosaccharide with an alcohol
4. in the reaction of a saccharide and orthophosphoric acid
5. in polycondensation of monosaccharides
6. in the reaction of cellulose with NaOH and carbon disulfide
7. in the reaction catalyzed by aminotransferases
8. in the reaction of the saccharide hemiacetal hydroxyl group with methanol

# Glucose water solution:

1. has a sweet taste
2. gives a positive Fehling´s test
3. has pH < 7
4. has pH > 7
5. gives a positive Selivanoff´s test
6. rotates the plane of polarized light
7. reduces solution of silver nitrate and ammonia (Tollens´ reagent)
8. oxidizes Fehling´s reagent

# Which of the following statements about monosaccharides is true:

1. xylose is a water-soluble substance
2. glucose is the only source of energy for erythrocytes
3. glucose is a stereoisomer of mannose
4. glucose can be synthesized from amino acids
5. galactose can be a constituent of lipids
6. fructose is a monomer of glycogen
7. galactose can be formed by the starch hydrolysis
8. ribose is formed in glycolysis

# Grape sugar is:

1. galactose
2. aldopentose
3. glucose
4. a compound containing 8 atoms of oxygen
5. water-insoluble
6. a structural isomer of fructose
7. a non-reducing saccharide
8. a structural component of cellulose

# Galactose is:

1. a component of complex lipids
2. aldohexose
3. ketohexose
4. the direct source of energy in erythrocytes
5. the water-soluble saccharide
6. saccharide present in the human body
7. milk sugar
8. polyhydroxyaldehyde

# Galactose is not:

1. a component of saccharose
2. a component of lactose
3. a component of any polysaccharides
4. a component of glycogen
5. a component of complex lipids
6. metabolized to glucose in the liver
7. a structural component of nucleosides
8. a reducing disaccharide

# Which of the following statements about oxidation and reduction of saccharides is true:

1. saccharides contain functional groups which can be oxidized
2. aldonic acids are products of partial oxidation of aldoses
3. lactic acid also belongs to the products which are produced during glucose oxidation in the human body
4. uronic acids are formed from aldose by the effect of strong oxidative reagents
5. polyols are products of moderate oxidation of pentoses
6. mannitol is a product of oxidation of fructose
7. hexitols have six optically active isomers
8. arabitol is a product of pentose reduction

# Following structure belongs to:



1. monosaccharide
2. α-anomer
3. β-anomer
4. D-fructose
5. optically inactive form of glucose
6. L-galactose
7. a reducing saccharide
8. DL-glucose

# Configuration in position C1 can be part of:



1. α-D-glucopyranose
2. α-L-glucopyranose
3. β-L-glucopyranose
4. β-D-glucopyranose
5. α -D-galactose
6. β-D-mannose
7. α-D-glucuronic acid
8. α-D-gluconic acid

# The compound represented by the following formula is formed by:



1. the oxidation of glucose
2. the reduction of mannose
3. the total reduction of galactitol
4. the oxidation of xylose
5. the reduction of aldohexose
6. the oxidation of glucitol
7. the reduction of saccharide with 4 asymmetric carbon atoms
8. the reduction of arabinose

# The following structure is:



1. polyhydroxyketone
2. a component of nucleotides
3. D-fructose
4. L-fructose
5. ketohexose
6. xylose
7. D-deoxyribose
8. arabinose

# Which of the following compounds give positive Fehling´s test:

1. glucose
2. ribose
3. glycogen
4. lactose
5. arabinose
6. galactose
7. malt sugar
8. grape sugar

# Critical for classification of deoxyribose to L- or D-configuration is:

1. configuration on carbon atom C2
2. configuration on carbon atom C3
3. configuration on carbon atom C4
4. configuration on carbon atom C5
5. concordant spatial configuration of the hemiacetal hydroxyl group and hydroxyl group on carbon atom C2
6. concordant spatial configuration of the hemiacetal hydroxyl group and hydroxyl group on carbon atom C4
7. ability or disability to react with phosphoric acid
8. spatial conformation on the last asymmetric carbon atom

# Aldotetroses can form:

1. colloidal solutions
2. 4 optical isomers
3. 6 optical isomers
4. carboxylic acids after the oxidation
5. phosphate esters
6. glycosides
7. alcohols after the reduction
8. complex lipids

# Deoxyribose participating in DNA synthesis:

1. is reduced on the first carbon atom
2. is reduced on the second carbon atom
3. can react with phosphoric acid and the product of this reaction is nucleotide
4. can react with uracil in the human body and the product of this reaction is a nucleoside
5. can be a constituent of complex lipids
6. binds to guanine by N-glycosidic bond
7. binds to cytosine by O-glycosidic bond
8. in the form of furanose binds to purine or pyrimidine bases

# Which of the following statements about monosaccharides is true:

1. they give a positive reaction with the biuret reagent
2. they can be formed in the intestine under the action of maltase
3. they can be formed in the intestine during the action of lactase on maltose
4. they are absorbed in the small intestine
5. they may be substrates for the synthesis of alcohol in the large intestine
6. they may be substrates for the synthesis of alcohol
7. they can generate homogeneous solutions
8. they can contain seven carbon atoms

# If an unknown saccharide gives the positive Molisch´s test, positive nitrochrome reaction and positive Fehling´s test, it can be:

1. mannose
2. lactose
3. sucrose
4. galactose
5. glycogen
6. the malt sugar
7. cellulose
8. ribose

# Glucose-6-phosphate is:

1. the phosphate monoester
2. the phosphate diester
3. a water-soluble substance
4. a substrate of glycolysis
5. a product of starch hydrolysis by the action of amylase
6. a product of glycogen hydrolysis by the action of amylase
7. a substrate for the synthesis of fructose-6-phosphate
8. synthesized also in human body

# Fructose:

1. can be synthesized from glucose in animal tissues
2. gives the positive Seliwanoff´s test
3. can be synthesized in plants
4. is a constituent of RNA
5. gives alcohol after the reduction
6. is a product of malt sugar hydrolysis
7. is the sweetest disaccharide
8. is not synthesized in human body

# Mannose:

1. is an epimer of arabinose
2. is a structural component of amylose
3. is formed during oxidation of mannitol
4. can exist in L- and D-form
5. gives a positive reaction with iodine
6. can be a component of glycosides
7. is produced by maltose hydrolysis
8. is the malt sugar

# Ribose:

1. in L-form is a structural component of nucleic acids
2. is a component of ATP molecule
3. gives the positive nitrochrome reaction
4. is a ketose
5. is a product of hydrolysis of the RNA molecule
6. is synthesized also in human body
7. cannot be esterified with trihydrogen phosphoric acid
8. gives the positive Fehling´s test

# A part of a sucrose molecule is:

1. an aldopentose
2. a ketohexose
3. a phosphoesteric bond
4. a chemical bond cleaved by hydrolases
5. a glycosidic bond
6. an esteric bond
7. a free hemiacetal hydroxyl group
8. a chemical bond cleaved by saccharase

# Which of the following compounds have not reducing properties:

1. glucose
2. sucrose
3. glyceraldehyde
4. glucopyranosyl-glucopyranose
5. lactose
6. cellulose
7. mannose
8. glycogen

# Beet sugar is:

1. a non-reducing saccharide
2. a plant monosaccharide
3. the substrate for the enzyme amylase
4. a compound digested by salivary amylase
5. the water-soluble saccharide
6. present in the sugar beet (16-20 %)
7. the product of starch hydrolysis
8. a monomer of glycogen

# Milk sugar is:

1. galactose
2. the saccharide cleaved in the small intestine by lactase
3. a non-reducing disaccharide
4. galactopyranosyl-fructofuranose
5. a saccharide of animal origin
6. cleaved in the small intestine by pancreatic amylase
7. the product of lactic acid oxidation
8. the product of lactic acid fermentation

# Galactose is:

1. the fruit sugar
2. a compound synthesized also in human body
3. the milk sugar
4. a reducing disaccharide
5. a structural component of lactic acid
6. a substrate for pancreatic lipase
7. a product of glycogen cleavage in the small intestine
8. a structural component of complex lipids

# During maltose hydrolysis following compound is formed:

1. glucose
2. mannose
3. glucose and mannose
4. mannose and galactose
5. a reducing monosaccharide
6. a non-reducing monosaccharide
7. a product which is absorbed in the small intestine
8. maltase

# In animal organisms, the following compounds are synthesized:

1. ribose
2. lactose
3. hemicellulose
4. cellulose
5. glycogen
6. starch
7. deoxyribose
8. arabinose

# Formation of lactose from monosaccharides is:

1. the addition reaction
2. esterification
3. condensation
4. polymerisation
5. accompanied by the formation of a glycosidic bond
6. hydrolysis
7. acetylation
8. oxidation

# Conversion of maltose to glucose is the reaction:

1. which takes place in the stomach
2. hydrolytic
3. oxidative
4. transamination
5. which takes place in the small intestine
6. esterification
7. which physiologically takes place in humans during digestion
8. catalysed by salivary amylase

# Maltose:

1. is a reducing disaccharide
2. can be formed from glucose
3. can be formed from starch
4. after cleavage gives glucose and galactose
5. can be hydrolysed by maltase
6. can be synthesized by mannose oxidation
7. can be synthesized by mannitol reduction
8. is non-digestible for humans

# The water solution of maltose:

1. can be hydrolysed by disaccharidase
2. is colloidal
3. gives a positive Fehling´s test
4. gives a positive reaction with iodine
5. gives a positive Molisch´s test
6. has a neutral pH
7. is decomposed by saccharase
8. is formed during hydrolysis of cellulose by amylase

# Sucrose is:

1. a disaccharide of plant origin
2. a reserve substance in humans
3. a component of starch
4. a compound important as an energy substrate in humans
5. the product of amylase action on amylose
6. a poorly water-soluble compound
7. a compound enzymatically cleaved by saliva in the mouth cavity
8. a syrupy non-crystallizing compound

# Reducing disaccharide is formed by:

1. linking hemiacetal hydroxyl groups of both monosaccharides molecules
2. linking the hemiacetal hydroxyl group of one monosaccharide molecule with the alcohol hydroxyl group of the second monosaccharide molecule
3. linking glucose and galactose by the α(1-1) glycosidic bond
4. the oxidation of glucitol
5. the oxidation of aldonic acid
6. the hydrolytic cleavage of starch by amylase catalytic action
7. the connection of purine with ribose
8. the action of saccharase on sucrose

# Polysaccharides:

1. can form true solutions
2. are not ionized in aqueous solutions
3. are generally water-insoluble substances
4. are cleaved by aminotransferases
5. have a sweet taste
6. can reduce solution of AgNO3
7. are cleaved by hydrolases
8. are resorbed unchanged in the small intestine

# Starch is:

1. a common component of human food
2. a compound that generates a blue color after the reaction with iodine
3. a compound containing 1,6-glycosidic bonds
4. cleaved by salivary amylase
5. a polysaccharide with the linear molecule
6. homopolysaccharide
7. hydrolysed by amylase
8. a compound giving a positive Fehling´s test

# In the molecule of starch there are:

1. chemical bonds cleaved by hydrolases
2. β-glycosidic bonds
3. 1,4-glycosidic bonds
4. 2,6-glycosidic bonds
5. phosphodiester bond
6. peptide bonds
7. diester bonds
8. α-glycosidic bonds

# Dextrins are formed:

1. by partial hydrolysis of starch
2. by the action of saccharase on glycogen
3. by esterification of starch
4. as intermediates of glycogen hydrolysis
5. by cleavage of starch with amylose
6. by the reaction of starch and cellulose
7. by phosphorylation of glycogen
8. by dissolving glycogen in water

# Starch is not present in:

1. the liver
2. potatoes
3. cereals
4. the human muscle
5. neurons
6. plant seeds
7. plant cells
8. red blood cells

# Which of the following compounds belong to polysaccharides of animal origin:

1. pectins
2. glycogen
3. cellulose
4. hemicellulose
5. amylose
6. amylopectin
7. arabinose
8. lecithin

# Glycogen:

1. is a white amorphous powder
2. is present in cells of skeletal muscle
3. is a storage substance
4. is water-soluble
5. is stained blue by iodine
6. is present in liver cells
7. decomposes in the stomach by the action of amylase
8. is cleaved in the small intestine by the action of pancreatic lipase

# The most widespread polysaccharide in the biosphere is:

1. starch
2. glycogen
3. dextrins
4. cellulose
5. amylopectin
6. amylose
7. lignin
8. hemicellulose

# Cellulose is:

1. a plant polysaccharide
2. an animal polysaccharide
3. a storage substance
4. the structural component of plant cells
5. the component of lignin
6. the component of wood
7. a resin
8. raw material for the production of viscose rayon

# The molecule of cellulose contains:

1. α-glycosidic bonds
2. β-glycosidic bonds
3. 1,6-glycosidic bonds
4. 2,4-glycosidic bonds
5. oxidation products of glucose
6. molecules of carboxylic acids bound by the ester bond
7. free carboxylic groups
8. 1,4-glycosidic bonds

# The starch molecule is formed:

1. by esterification
2. by polycondensation
3. by phosphorylation
4. by hydrolysis
5. in plant cells
6. in liver cells
7. by linking multiple glucose molecules with a diester bond
8. from non-reducing monosaccharides

# Glycogen is:

1. a reducing saccharide
2. a non-reducing saccharide
3. the compound that gives a positive Fehling´s test
4. the compound that gives a positive Tollens´ test
5. a common component of muscle cells
6. the storage form of glucose in the human body
7. the reserve substance in cereal grains
8. non-digestible in man

# In the cellulose synthesis participates:

1. glucose
2. β-1,6-glycosidic bond
3. condensation reaction
4. maltose
5. fructose
6. β-1,4-glycosidic bond
7. esterification reaction
8. amylase

# Complete hydrolysis of starch gives rise to a product which:

1. gives a positive reaction with iodine
2. gives the positive Tollens´ test
3. can serve as a source of energy for the muscle tissue
4. can be absorbed in the human small intestine
5. enters the glycolysis
6. has reducing properties
7. can produce esters with phosphoric acid
8. gives glucitol after the reduction

# Starch gives a positive reaction with:

1. Molisch´s reagent
2. iodine solution
3. Seliwanoff´s reagent
4. solution of basic fuchsine
5. thymol reagent
6. ethanolic solution of 1-naphtol
7. solution of copper (II) sulfate
8. nitrochrome reagent

# The binding of monomers in the amylose molecule is carried out by:

1. the linkage produced by hydrolases
2. O-glycosidic bond
3. α(1-6)-glycosidic bond
4. α(1-4)-glycosidic bond
5. the linkage that is hydrolysable by galactosidase
6. ester bond
7. the linkage that may be cleaved by acids
8. the linkage that is present in the maltose molecule

# In the glycogen molecule we can find:

1. 1,4-glycosidic bonds
2. 1,6-glycosidic bonds
3. N-glycosidic bonds
4. ester bonds
5. molecules of glucose and galactose as monomers
6. linked molecules of orthophosphoric acid
7. macroergic bonds
8. α-glycosidic bonds

# Partial hydrolysis of starch by amylase generates:

1. the product that is absorbed in the human small intestine
2. dextrins
3. a substance that is physiologically present in human blood
4. glycogen
5. lactose
6. amylase
7. glucose
8. a compound that belongs to oligosaccharides

# The branched structure has a molecule of:

1. glycogen
2. amylose
3. cellulose
4. amylopectin
5. maltose
6. lactose
7. arabinose
8. ethanolamine

# 1,6-glycosidic bond:

1. is formed by the condensation reaction
2. is a peptide bond
3. enables a branched structure of glycogen
4. is present in the molecule of amylose
5. is cleaved by the enzyme maltase
6. is cleaved by a hydrolytic enzyme formed in the small intestine
7. is present in the molecule of fructose
8. is present in the molecule of glycogen

# Non essential amino acids:

1. the organism can synthesize from oxo acids
2. can be formed by the transamination from pyruvate and also oxaloacetate
3. must be taken by food
4. are aspartic acid and glutamic acid
5. are dispensable amino acids
6. are also taken by food
7. are also acidic amino acids
8. are tryptophan and phenylalanine

# Amino acid with an aromatic ring is:

1. phenylalanine
2. an amino acid present only in peptides and not in proteins
3. valine
4. tyrosine
5. 2-amino-3-phenylpropanoic acid
6. glutamic acid
7. the amino acid which contains the benzene ring on beta-carbon of alanine
8. glutamic acid and its amide – glutamine

# Acidic amino acids:

1. contain two amino groups in the molecule
2. are aspartic and glutamic acid
3. contain two carboxyl groups in the molecule
4. in addition to carboxyl groups they also contain one -NH2 group
5. pH of their aqueous solution is higher than 7
6. pH of their aqueous solution is less than 7
7. in the organism they form corresponding amides
8. contain two -COOH groups and one amino group in the molecule

# Basic amino acids:

1. may bind a proton from the environment
2. contain the -SH group
3. are aspartic and glutamic acids
4. contain, e.g. one carboxy group and two -NH2 groups
5. include lysine which is an essential amino acid
6. include serine
7. are predominantly found in nucleoprotein forming proteins
8. are predominantly present in histones

# Amino acid in this form:



1. may have dissociated functional groups in an aqueous solution as shown in this structure
2. is a zwitterion
3. shows no total charge
4. in the electric field half of molecules move to the cathode and half of the molecules to the anode
5. does not move in the electric field of the direct current
6. is an ammonium salt
7. is a neutral amino acid
8. is alanine

# Which of the following statements about amino acids in proteins of the human organism is true:

1. after degradation their amino nitrogen occurs in uric acid
2. they have L-configuration
3. they have L- or D-configurations
4. they have one -NH2 group bound to the alpha carbon (towards the carboxyl group)
5. they also occur in food proteins
6. they are synthesized in the human organism from CO2, H2, NH3
7. urea is formed as a waste product during their degradation
8. they contain only -NH2 and -COOH functional groups

# An amide group:

1. is the -NH2 group bound to a carbon in the amino acid chain
2. occurs in amino acids of proteins
3. has a strongly acidic character
4. of an amino acid releases the proton into the solution
5. may bind a proton from the solution more strongly than the amino group
6. in molecules of amino acids in the alpha position is involved in the formation of the peptide bond
7. occurs in glutamine
8. in basic building units of proteins is bound directly to the carbon chain



# Essential amino acids:

1. may be synthesized by the organism from oxo acids by the transamination
2. are indispensable amino acids
3. must be present in food
4. are glycine and alanine
5. contain the -NH2 group in the beta-position
6. are, e.g. lysine and tryptophan
7. contain the alpha-amino group
8. occur in the organism free as well as bound in proteins

# Which of the following amino acids contains the -OH group in the molecule:

1. ethanolamine
2. serine
3. methionine
4. threonine
5. phenylalanine
6. choline
7. proline
8. tyrosine

# 2-aminosuccinic acid is:

1. aspartic acid
2. alanine
3. amino acid which does not occur in proteins
4. amino acid with two carboxyl groups in the molecule
5. a compound of the formula



1. an acidic amino acid
2. a compound with one more carbon than glutamic acid
3. a four carbon amino acid

# 2-aminopropanoic acid is:

1. alanine
2. glycine
3. an amino acid with one chiral carbon atom in the molecule
4. a neutral amino acid
5. a part of proteins and in the human organism occurs as L-amino acid f)



1. present in humans in the form of D-amino acid
2. an amino acid without chiral carbon in the molecule

# CH3-CH(NH2)-COOH:

1. is an alpha-amino acid
2. is alanine
3. is formed by transamination of pyruvic acid
4. is a neutral amino acid
5. is glycine
6. is a basic amino acid
7. in proteins can be substituted by the compound



1. in a solution at pH = pI is in the form of zwitterion

# 2-amino-3-phenylpropanoic acid:

1. contains the -NH2 group at the beta position from the -COOH group
2. is phenylalanine
3. contains the benzene ring
4. is a heterocyclic compound
5. is an aromatic amino acid
6. is an amino acid from which tyrosine may be formed by the hydroxylation



1. is a compound of the formula
2. is tryptophan

# A peptide bond:

1. does not occur in molecules of amino acids
2. present in food components is digested in the digestive tract by pepsin
3. can be detected by the Fehling reaction
4. does not occur in dipeptides
5. connects amino acids in proteins
6. is the bond -CO-NH-
7. is formed in the process of transcription in the nucleus
8. is formed in the process of translation in proteosynthesis

# Which of the following statements about the peptide bond is true:

1. amino acids in dipeptides are connected by this bond
2. water is consumed during its formation
3. it is the ionic non-polar bond
4. it is a strong covalent bond
5. energy is required during its formation
6. two protein chains during the formation of the secondary structure are connected by this bond
7. the bond is destroyed when denatured
8. the bond is cleaved by proteinases

# During the formation of a peptide bond:

1. identical or different amino acids may bind
2. proteinases are required
3. the -COOH group of one amino acid reacts with the -NH2 group of the same amino acid
4. the -COOH group of one amino acid reacts with the -NH2 group of another amino acid
5. the -CO-NH- bond connects amino acids
6. a large amount of energy is released
7. energy is consumed
8. water is released

# Dipeptide:

1. is composed of two amino acids
2. is composed of two peptides
3. is composed of two proteins
4. is composed of three amino acids
5. is, e.g. alanyl-glycine
6. unlike proteins does not contain the higher order structures
7. contains two peptide bonds
8. contains one -CO-NH- bond

# Which statement about acidic amino acids is true:

1. they contain more carboxyl groups than -NH2 groups
2. they are aspartic acid and glutamic acid
3. they are also found in enzymes
4. they are 2-oxoglutaric acid and aspartic acid
5. they are diamino mono-carboxylic amino acids
6. they are bound in proteins and contain an oxo-group attached to the second carbon atom
7. during the protein formation one acidic amino acid provides both carboxyl groups to produce the peptide bond
8. these amino acids and their amides are part of proteins

# During transamination there are formed amino acids:

1. and a coenzyme of this reaction is thiamine
2. non essential (also in humans)
3. from corresponding oxo acids
4. from long-chain carboxylic acids
5. which can occur in proteins, e.g. alanine
6. e.g. aspartic acid
7. tryptophan from tyrosine
8. and the coenzyme of this reaction is a derivative of vitamin B6

# The primary structure of proteins:

1. means a spatial arrangement of the polypeptide chain, e.g. alpha-helix
2. means the sequence of amino acids in a protein chain
3. is responsible for protein properties
4. is determined by the sequence of nucleic bases in a protein chain
5. is encoded in DNA
6. is stabilized by bonds between -NH2 and -COOH groups of the consecutive amino acids
7. is stabilized by ester bonds
8. is destroyed by the denaturation

# A final (waste) product of the protein metabolism in humans:

1. is a compound with two -NH2 groups
2. is diamide of carbonic acid
3. is uric acid
4. are amino acids excreted by the urine
5. is urea
6. is a poorly soluble compound which is a part of kidney stones
7. is a compound with the formula H2N-CO-NH2
8. is only ammonia

# Amino acids:

1. some also contain nitrogen in their heterocyclic structure
2. are formed by the hydrolysis of proteins
3. essential amino acids cannot be formed in the organism from oxo acids by transamination
4. are monomers of all biopolymers in the organism
5. are functional derivatives of carboxylic acids
6. all contain the group



1. are bound in proteins by the covalent bond
2. are ampholytes

# Glycine:

1. is the simplest amino acid
2. does not contain asymmetric carbon in its molecule
3. is a substitution derivative of acetic acid
4. belongs to functional derivatives of ethanoic acid
5. is a functional derivative of acetic acid
6. has the H2N-CH2-COOH formula
7. is amino propionic acid
8. is a neutral amino acid with three carbons

# Glutamic acid:

1. together with aspartic acid belongs to acidic amino acids
2. is dicarboxylic 2-oxo acid
3. is five carbon mono amino three carboxylic acid
4. contains two carboxylic groups in the molecule
5. is an essential amino acid
6. is a non-essential amino acid
7. contains one -NH2 group in the molecule
8. and its amide occur in proteins

# Which of the following statements about the secondary structure of proteins is true:

1. it can be broken only by the hydrolysis of the peptide bond
2. it can be in the form of alpha helix
3. it is stabilized by hydrogen bridges
4. it determines the sequence of amino acids in a chain
5. unlike the primary structure it can be broken by denaturation
6. it is stabilized only by peptide bonds
7. it is stabilized by bonds formed among groups >C=O ….. H˗N< of peptide bonds
8. it can occur in the form of a pleated sheet

# Tyrosine:

1. belongs to neutral amino acids
2. is a hormone
3. contains the -OH group in the molecule
4. can be phosphorylated in proteins
5. differs from phenylalanine by the presence of the hydroxyl group in the molecule
6. contains a heterocycle, amine-, hydroxyl- and carboxyl groups in the molecule
7. is an aromatic amino acid
8. is a conditionally essential amino acid

# 2-amino-3-hydroxy propanoic acid is:

1. a neutral amino acid
2. serine
3. alanine
4. a compound with the formula HOOC-CH2-CH(NH2)-CH2-OH
5. an essential amino acid
6. a non-essential amino acid
7. a part of some phospholipids
8. a functional derivative of propanoic acid

# Protein molecules:

1. are composed of acids containing only the -NH2 group as the functional group
2. are composed of 20 different amino acids
3. contain amino acids in L-configuration
4. are not found in the blood of a healthy person
5. can be classified to fibrillar and globular
6. are important biocatalysts
7. can be denatured *in vitro* by the high temperature
8. do not lose their biological activity by the denaturation

# By protein denaturation:

1. a protein loses biological properties because peptide bonds are cleaved
2. the primary structure is damaged
3. the polypeptide chain is cleaved into smaller portions
4. there is a permanent change of the spatial arrangement of molecules
5. higher order structures are not damaged
6. their biological properties are lost
7. no damage to the secondary structure occurs
8. higher order protein structures are damaged

# Proteins:

1. are cleaved in the stomach and the small intestine
2. participate in the transport of some compounds in blood, e.g. lipids
3. are biocatalysts
4. are cleaved by amylase
5. have no regulatory function
6. are also some hormones
7. cannot be synthesized in the organism, they are taken only by food
8. some have a structural function

# Oxygen:

1. is a biogenic macroelement
2. belongs to electropositive elements
3. is transported from lungs to tissues by myoglobin
4. is transported from lungs to tissues by hemoglobin
5. is the last acceptor of electrons in the electron transport chain
6. in water is bound with the ionic bond
7. is an electronegative element which can form hydrogen bonds with other molecules
8. in hydrogen peroxide is monovalent, and in the molecule of water it is bivalent

# Water in the organism:

1. enables the transport of substrates
2. is a non-polar solvent
3. is a solvent for vitamin C
4. makes approx. 60 % of the adult weight
5. is received just from food
6. is not produced in metabolic processes
7. serves for the transport of waste products
8. is a product of terminal oxidation

# Colloids:

1. are stabilized by the electrical charge on their surface
2. are not true solutions
3. are true solutions
4. are solutions containing 1-1000 nm particles
5. are solutions of monosaccharides
6. can be produced from low-molecular weight substances if these are aggregated to bigger units (micelles)
7. are homogeneous systems
8. loose their stability in solutions if they loose an electrical charge or if they have disrupted a hydration shell

# The endergonic reactions are associated with:

1. catabolic processes
2. synthesis of macromolecules
3. production of proteins
4. anabolic processes
5. energy release
6. the consumption of energy in the form of ATP
7. transformation of glucose to glucose-6-phosphate and fructose to fructose-1,6-bisphophate
8. β-oxidation of fatty acids

# Energy-rich compounds are:

1. AMP
2. GTP
3. acetyl coenzyme A
4. GDP
5. ADP
6. GMP
7. adenosine triphosphate
8. adenosine

# Acetyl coenzyme A can be produced:

1. from carbohydrates
2. from lipids
3. from amino acids
4. from pyruvic acid
5. directly from lactic acid
6. directly from oxaloacetic acid
7. from acetone
8. directly from acetoacetyl coenzyme A

# Dehydrogenation is:

1. for example the oxidation of succinic acid to fumaric acid
2. performed by oxidoreductases in the organism
3. reduction
4. for example the condensation reaction
5. removing the water molecules
6. oxidation
7. reduction of pyruvic acid to lactic acid
8. removing hydrogen atoms from a substrate

# The Krebs cycle proceeds in the cell:

1. in the nucleus
2. in the mitochondria
3. in the cytosol
4. in the endoplasmic reticulum
5. to provide energy and produce important intermediates
6. under anaerobic conditions
7. under aerobic conditions
8. and leads to decarboxylation of substrates

# The final product of glucose oxidation in the human under anaerobic conditions is:

1. ethanol
2. acetyl coenzyme A
3. 2-hydroxypropanoic acid
4. lactic acid
5. acetoacetic acid
6. pyruvic acid
7. carbon dioxide
8. lactate

# Which of the following processes proceeds in mitochondria:

1. oxidation-reduction reactions in the respiratory chain
2. oxidation of the Krebs cycle intermediates
3. oxidative phosphorylation
4. β-oxidation of long-chain fatty acids
5. reactions of glycolysis
6. synthesis of fatty acids
7. synthesis of most proteins
8. oxidation of reduced coenzymes of most oxidoreductases

# Carbohydrates in the body taken from the food:

1. can be polysaccharides, for example glycogen
2. are digested by hydrolases in the gastrointestinal tract
3. contain β-glycosidic bonds, for example, starch
4. are often coenzymes of reactions
5. are oxidized and cleaved with energy consumption
6. are metabolized to acetyl coenzyme A, which can enter the Krebs cycle
7. at their excess they can be transformed to lipids
8. are absorbed from the gastrointestinal tract as monosaccharides

# Which of the following compounds can be formed during glucose oxidation in glycolysis under aerobic conditions:

1. CO2 and water
2. 2-oxopropanoic acid
3. pyruvic acid
4. glycogen
5. acetoacetic acid
6. oxaloacetic acid
7. oxo-acid with one carboxylic group
8. lactic acid

# One molecule of glucose can provide:

1. 1 molecule of acetyl coenzyme A
2. 2 molecules of acetyl coenzyme A
3. 3 molecules of acetyl coenzyme A
4. 4 molecules of acetyl coenzyme A
5. 1 molecule of pyruvic acid
6. 2 molecules of pyruvic acid
7. 2 molecules of lactate
8. 1 molecule of lactic acid

# Which of the following statements about simple lipids is true:

1. they are an important source of energy in the organism
2. they are stored in the form of triacylglycerols
3. they can be a source of energy for heart
4. they are the source of amino acids in the organism
5. received by the food they are digested by pancreatic lipase
6. together with phospholipids they are important components of biological membranes
7. they can not be synthetized in the organism, they are only received from the food
8. they form lipoproteins to be transported in the blood stream

# Lipase is:

1. a hydrolase
2. a protease
3. a digestive enzyme
4. an enzyme cleaving triacylglycerols
5. a hormone, which regulates the level of serum lipids
6. an enzyme, which cleaves lipids received from the food
7. an enzyme, which phosphorolytically cleaves lipids
8. produced in the pancreas

# Proteolytic enzymes of the digestive tract are produced in the:

1. stomach
2. pancreas
3. large intestine
4. gall-bladder
5. salivary glands
6. serum
7. erythrocytes
8. liver

# Enzymes:

1. increase the velocity of a chemical reaction
2. move the equilibrium of the reaction in the direction of product formation
3. move the equilibrium of the reaction in the direction of substrate creation
4. increase the free activation energy of the catalysed reaction
5. do not have the pH-optimum
6. their catalytic effect is higher after their activation
7. cannot have a non-protein component in their molecule
8. can be synthesized in an inactive form

# Coenzyme:

1. is a protein part of an enzyme
2. is a non-protein part of an enzyme
3. is a product of enzyme reaction
4. is an alloesteric site of an enzyme
5. of transamination reactions is a phosphorylated form of vitamin B6
6. can be the same for a few types of enzymes
7. is very often a vitamin
8. of oxidation-reduction enzymes is NAD+

# For the substrate specificity of an enzyme, there is responsible:

1. apoenzyme
2. coenzyme
3. pH-optimum
4. decrease of activation energy
5. protein part of enzyme
6. the presence of metal ions
7. optimal temperature
8. activation of enzymes by activators

# pH-optimum of an enzyme:

1. is always around 7
2. depends on the type of the enzyme
3. can be around 7
4. depends on the amount of a substrate
5. is a pH, with the lowest enzyme activity
6. pepsin is in a strongly acidic range (pH = 1-2)
7. is a pH with the highest enzyme activity
8. is characteristic for each enzyme

# Pepsin:

1. is produced by the pancreas
2. is a coenzyme
3. catalyzes the cleavage of peptides
4. has the optimal pH around 2
5. is a hydrolytic enzyme
6. is synthesized in the form of zymogene
7. digests proteins in the stomach
8. is ligase

# Competitive inhibition is a type of enzyme inhibition when:

1. the inhibitor binds to the active site of the enzyme
2. the inhibitor does not bind to the active site of the enzyme
3. the inhibitor does not bind to the enzyme
4. the inhibitor binds to the coenzyme
5. the inhibitor has a similar structure as a substrate
6. the inhibitor does not occupy the same site as the substrate
7. the effect of an inhibitor can be reduced by the increased concentration of the substrate
8. the enzyme is irreversibly inhibited

# Enzymes are classified:

1. according to the type of their substrate
2. according to the type of chemical reaction, which they catalyze
3. to 6 main classes
4. to 4 main classes
5. according to the type of coenzyme
6. to apoenzymes and coenzymes
7. according to the type of their product
8. not according to the type of their substrate

# Hydrolases are:

1. pepsin
2. proteinases
3. transaminase
4. lipase
5. trypsin
6. decarboxylase
7. dehydrogenase
8. chymotrypsin

# Oxidoreductases are enzymes which:

1. catalyse the oxidation of a substrate
2. catalyse the reduction of a substrate
3. use pyridoxine as a coenzyme
4. use NAD+ as a coenzyme
5. are located also in mitochondria
6. are located in lysosomes
7. catalyse dehydrogenation
8. catalyse the conversion of lactose to glucose and galactose

# The rate of enzyme reaction can be increased by:

1. the increase in a substrate concentration
2. the increase in the product concentration
3. the decrease in a substrate concentration
4. the temperature decrease below 37 °C
5. the increase of the enzyme amount if there is an excess of the substrate
6. the presence of enzyme activators
7. the excess of coenzyme
8. rising the temperature from 30 °C to 37 °C

# The energy in the form of ATP is:

1. mainly produced in the organism by the oxidation of substrates
2. utilized in exergonic reactions
3. used for the activation of substrates
4. produced in processes of oxidative phosphorylation
5. used for muscle contraction
6. produced in the respiratory chain
7. produced in mitochondria
8. the most important source of energy in the human organism

# Oxidations of substrates:

1. are located in the cytosol and also in mitochondria
2. are catalysed by transferases
3. are catalysed by enzymes with NAD+ and FAD as coenzymes
4. are also reactions of the Krebs cycle
5. are also catalysed by dehydrogenases
6. in the first phase lead to the production of reduced coenzymes
7. in living systems are normally not one-stage processes
8. lead to the production of energy in the organism

# Zymogen:

1. is an active form of an enzyme
2. can be changed to the active form by cleaving a part of a peptide chain
3. is proenzyme
4. is an inactive form of an enzyme
5. is also pepsinogen
6. is also trypsin
7. consists of amino acids linked by a glycosidic bond
8. is a protein

# Synthetases:

1. are ligases
2. catalyse reactions, which need energy from ATP
3. catalyse reactions of the combining two substrate molecules
4. are lyases
5. do not need energy for their activity
6. catalyse endergonic reactions
7. catalyse energy-producing reactions
8. catalyse exergonic reactions

# Vitamins:

1. are coenzymes and regulatory factors
2. are often high-molecule organic compounds
3. their amount in the organism is small
4. do not belong to essential substances
5. A, D, E, K are not fat soluble
6. C, B1, B6 are water soluble
7. their deficiency causes hypovitaminoses
8. are important also in the metabolism of amino acids as coenzymes

# Oxidation (dehydrogenation) of substances in the living system:

1. occurs mainly in the presence of oxygen
2. can also occur in the absence of oxygen
3. is catalysed by dehydrogenases (for example alcohol dehydrogenase)
4. is catalysed by hydrolases
5. leads to the production of energy in the form of ATP
6. can be a multi-step process (for example oxidation of glucose)
7. provides the energy for exergonic reactions in the organism
8. is for example the change of lactic acid to pyruvic acid

# Acetyl coenzyme A:

1. is an active form of acetic acid
2. can be produced from glucose
3. is oxidized in Krebs cycle
4. its oxidation is not important for energy production
5. is also a product of β-oxidation of fatty acids
6. is not the macroergic (energy-rich) compound
7. is a substrate for several synthesis
8. is produced directly from lactic acid

# Which of the following statements about citric acid cycle is true:

1. its enzymes are localized in mitochondria
2. it represents reactions, which mediate the production of ATP
3. one of its intermediates is glutamic acid
4. it starts with the condensation of citric acid and oxaloacetic acid
5. it enables oxidation of acetyl coenzyme A to CO2
6. one of its intermediates is oxaloacetic acid
7. it is also called the Krebs cycle
8. its enzymes are located in the cytosol

# Glucose:

1. is phosphorylated to glucose-1-phosphate in glycolysis
2. can be changed to ethanol in yeasts
3. is converted to pyruvic acid in glycolysis
4. in anaerobic glycolysis is converted to lactic acid
5. is a monomer of glycogen
6. is the product of CO2 and H2O assimilation in yeasts during the process of photosynthesis
7. in excess can be stored in the form of glycogen
8. in healthy people is not present in the urine

# Glycolysis:

1. is a metabolic pathway of glucose oxidation
2. can be aerobic and anaerobic
3. is a process, in which energy is not produced
4. under anaerobic conditions pyruvic acid is the end product
5. under anaerobic conditions lactic acid is the end product in human
6. under anaerobic conditions acetyl coenzyme A is the end product
7. is located in the cytosol
8. is a process, in which the organism can produce energy also under anaerobic conditions

# Lipids:

1. in the heart can be used as a source of energy
2. are less important source of energy as proteins
3. are simple and complex lipids
4. are digested hydrolytically by lipases
5. are a structural part of cell membranes
6. simple are hydrophobic substances
7. simple are neutral fats
8. are transported in the form of lipoproteins in the blood

# Acetyl CoA:

1. can be formed in the metabolism of saccharides
2. is formed by β-oxidation of fatty acids
3. is metabolized in Krebs cycle
4. is a substrate for the synthesis of steroids
5. contains the thioester bond
6. does not belong to energy-rich compounds
7. enters the Krebs cycle after condensation with citric acid
8. is a substrate for the synthesis of some hormones

# Lipase:

1. participates in the synthesis of lipids
2. belongs to hydrolytic enzymes
3. cleaves triacylglycerols
4. activates fatty acids
5. participates in β-oxidation of fatty acids
6. is hydrolase
7. requires water as one of the reaction substrates
8. can be pancreatic and lipoprotein

# Which of the following statements about the synthesis of fatty acids is true:

1. for their synthesis directly glycerol is used
2. for their synthesis acetyl CoA is used
3. multicellular organism cannot produce saturated fatty acids
4. multicellular organism can produce essential fatty acids with more double-bonds
5. it is an exergonic process
6. it is an endergonic process
7. it is a process catalysed by lipase
8. also occurs in adipocytes

# Estrogens are:

1. sex hormones
2. the main product of ovary
3. the main product of testicles
4. under the control of adenohypophysis
5. derivatives of pyridine
6. derivatives of sterane
7. synthesized from cholesterol
8. hormones containing an aromatic ring

# Following products are synthesized in the anterior pituitary (adenohypophysis):

1. calcitonin
2. prolactin
3. testosterone
4. gonadotropin
5. adrenocorticotropic hormone
6. growth hormone
7. vasopressin
8. antidiuretic hormone

# Calcitonin:

1. is a hormone of thyroid gland
2. is a hormone of the parathyroid gland
3. increases the calcium level in the blood
4. enhances the release of calcium from bones
5. promotes the deposition of calcium into bones
6. is water insoluble
7. is secreted into the blood after the decrease of plasma calcium level
8. is composed of amino acids

# Aldosterone:

1. increases the blood sodium level
2. increases excretion of potassium into the urine
3. is of the steroid nature
4. is synthesized from tyrosine in the adrenal medulla
5. is structurally similar to epinephrine
6. is synthesized in the adrenal cortex together with androgens
7. increases the blood calcium level
8. accelerates the heart rate

# In the medulla of adrenal gland the following compound is formed:

1. cortisol from cholesterol
2. glucagon from amino acids
3. epinephrine from tyrosine
4. somatotropin from amino acids
5. norepinephrine from cholesterol
6. theophylline from pyrimidines
7. catecholamines from aromatic amino acids
8. adrenocorticotropic hormone from amino acids

# Insulin:

1. increases the entry of the glucose into the cells
2. delays oxidation of glucose in the cells
3. is of the peptide nature
4. increases the conversion of carbohydrates to lipids
5. promotes fat storage
6. is synthesized in the exocrine part of the pancreas
7. increases the blood glucose level
8. decreases the blood glucose level

# Which of the following compounds has the opposite effect of insulin on carbohydrate metabolism:

1. cortisol
2. follicle stimulating hormone
3. aldosterone
4. glucocorticoids
5. epinephrine
6. calcitonin
7. glucagon
8. hormones of the adrenal medulla

# Testosterone:

1. regulates the menstrual cycle
2. promotes the synthesis of proteins
3. is a hormone of the steroid nature
4. is synthesized from cholesterol
5. belongs to anabolic hormones
6. is increasingly secreted in puberty
7. promotes the development of secondary sexual characteristics
8. increases the blood glucose level

# Serum potassium level is controlled by:

1. the thyroid gland
2. the parathyroid gland
3. the adrenal gland
4. one of the steroid hormones
5. aldosterone
6. mineralocorticoids
7. the liver
8. one of the adrenal medulla hormones

# The secretion of progesterone:

1. is stimulated by a follicle stimulating hormone
2. is increased by a luteinizing hormone
3. is affected by the adenohypophysis
4. stimulates one of the hormones of the posterior pituitary
5. in men begins in puberty
6. occurs from corpus luteum (the yellow endocrine body)
7. depends on the insulin level
8. is parallel to the secretion of estrogens

# Steroid nature have:

1. testosterone
2. adrenocorticotropic hormone
3. cholesterol
4. bile pigments
5. ergosterol
6. gonadotropin
7. estradiol
8. aldosterone

# Which of the following statements about the effects of hormones on tissues is true:

1. estrogens cause a decrease in the uterine musculature
2. testosterone increases the synthesis of muscle proteins
3. calcitonin decreases the blood glucose level
4. aldosterone increases the blood sodium level
5. parathormone increases the renal phosphate excretion
6. cortisol supports the synthesis of glucose from amino acids
7. glucocorticoids increase the blood glucose level
8. vasopressin supports water excretion in the kidney

# Iodine deficiency disturbs directly:

1. the function of the stomach
2. the function of the pancreas
3. the function of parathyroid glands
4. the function of the thyroid gland
5. the synthesis of parathormone
6. the synthesis of thyroxine
7. the synthesis of aldosterone
8. the synthesis of amino acid tyrosine

# The synthesis of glycogen in liver cells is supported by:

1. glucagon
2. one of the pancreatic hormones
3. epinephrine
4. a hormone synthesized from cholesterol
5. insulin
6. amylase
7. one of the hormones of the peptide nature
8. a hormone synthesized in the thyroid gland

# Testicles mainly produce:

1. estradiol
2. a steroid hormone
3. gonadotropins
4. a hormone synthesized from an aromatic amino acid
5. an anabolic hormone
6. a hormone supporting development of muscles
7. androgens
8. a hormone synthesized in the Graaf´s follicle

# Riboflavin:

1. belongs to the B-complex vitamins
2. is a derivative of thiazole
3. is a part of the coenzyme FAD
4. belongs to heterocyclic compounds
5. is a compound containing sulfur
6. is water soluble
7. is important for the course of oxidation-reduction reactions
8. is a part of coenzyme A

# Among the coenzymes of the amino acid metabolism, there does not belong:

1. thiamine
2. pantothenic acid
3. ascorbic acid
4. activated form of pyridoxine
5. calciferol
6. phosphorylated derivative of pyridoxine
7. thiazole
8. phosphorylated form of folic acid

# Vitamin K is needed for:

1. blood clotting
2. absorption of lipids in the human small intestine
3. photosynthesis
4. absorption of calcium
5. the synthesis of prothrombin
6. the normal kidney function
7. the synthesis of hemocoagulation factors
8. the correct testicle function

# For the production of red blood cells, the following substances are needed:

1. a vitamin containing cobalt
2. folic acid
3. riboflavin
4. vitamin B12
5. vitamin D
6. vitamin A
7. iron
8. zinc

# Retinol participates in:

1. the decarboxylation of amino acids
2. the transamination of amino acids
3. the oxidation and reduction of amino acids
4. the synthesis of carotene
5. the process of vision
6. the maturation of eggs in the ovary
7. the regulation of the blood glucose level
8. ensuring the proper function of epithelial cells

# Vitamin D3:

1. is of the plant origin
2. is fat soluble
3. increases the resorption of calcium in the small intestine
4. increases the renal excretion of calcium
5. is a heterocyclic compound
6. is synthesized from cholesterol
7. can be synthesized in human body
8. is cholecalciferol

# Which of the following compounds belong to essential factors for humans:

1. linoleic acid
2. ascorbic acid
3. lactic acid
4. malic acid
5. citric acid
6. pantothenic acid
7. glutamic acid
8. oleic acid

# The sulfur atom is present in the molecule of:

1. vitamin B1
2. riboflavin
3. vitamin B6
4. pantothenic acid
5. folic acid
6. thiamine
7. ascorbic acid
8. methionine

# Blood clotting disorders occur in:

1. avitaminosis E
2. hypervitaminosis A
3. calcium deficiency
4. lack of vitamin K
5. disorders of the liver function
6. disorders of the protein digestion and resorption
7. the deficiency of the bile acids secretion
8. hypovitaminosis of cobalamin

# Scurvy is:

1. the disorder of the connective tissue metabolism
2. the disorder of the nervous tissue metabolism
3. resulting from hypovitaminosis of folic acid
4. resulting from a lack of vitamin C
5. the disorder of collagen metabolism
6. the result of ascorbic acid deficiency
7. a disease of the central nervous system
8. one of the consequences of vitamin C hypervitaminosis

# Vitamin B12:

1. is a heterocyclic compound
2. is a derivative of pyrazole
3. is a derivative of pyrrole
4. contains cobalt
5. has corrin as a basic structure
6. is important for hematopoiesis
7. contains iron in its molecule
8. is a coenzyme of oxidation-reduction enzymes

# Vitamins:

1. are involved in the metabolism as coenzymes
2. serve as a source of energy
3. are absorbed in the small intestine
4. can be formed by the bacterial flora activity in the colon
5. are introduced into the organism only in the diet
6. can be stored in the liver
7. can also be synthesized in CNS
8. can interfere with the oxidation-reduction processes

# Carotene is:

1. a provitamin
2. vitamin A
3. a terpene alcohol
4. tetraterpene
5. a factor, excess of which causes anaemia
6. a water soluble substance
7. a heterocyclic compound
8. an orange-yellow pigment from carrots

# Which of the following compounds does not belong to provitamins:

1. riboflavin
2. ergosterol
3. pyridoxine
4. β-carotene
5. thyroxine
6. retinol
7. pepsinogen
8. folic acid

# Coenzyme FAD contains the following compound in its molecule:

1. vitamin B1
2. vitamin B2
3. vitamin B6
4. thiamine
5. nicotinamide
6. pyridoxine
7. riboflavin
8. adenine