

1. Which of the listed reactions indicates the basic properties of pyridine?

- a.
- b.
- c.
- d.
- e.

2. What of the given reagents is applied for determination of aldehyde group?

- a. $\text{Ca}(\text{OH})_2$
- b. $\text{Br}_2(\text{H}_2\text{O})$
- c. $[\text{Ag}(\text{NH}_3)_2]\text{OH}$
- d. Solution of KMnO_4
- e. 25% solution of H_2SO_4

3. What compound is formed by heating α -hydroxypropionic acid?

- a.
- b.
- c.
- d.
- e.

4. Which of the following names corresponds with the formula:

- a. Salicylic acid amide
- b. Anthranilic acid amide
- c. Isonicotinic acid amide
- d. Picolinic acid amide
- e. Nicotinic acid amide

5. What compounds entered into a reaction if its products were nitrobenzene and water:

- a. $\text{C}_6\text{H}_6 + \text{HNO}_3$ (concentrated) \rightarrow
- b. $\text{C}_6\text{H}_5\text{Cl} + \text{KNO}_2 \rightarrow$
- c. $\text{C}_6\text{H}_5\text{OH} + \text{NaNO}_2 \rightarrow$
- d. $\text{C}_6\text{H}_5\text{NH}_2 + \text{HNO}_2 \rightarrow$
- e. $\text{C}_6\text{H}_6 + \text{HNO}_2 \rightarrow$

6. Which of these formulas corresponds with acetoacetic acid?

- a.
- b.
- c.
- d.
- e.

7. What carbon atoms in the given compound are in the second valence state of (sp^2 -hybridization)?

- a. 1 and 3
- b. 3 and 4
- c. 5 and 6
- d. 1 and 2
- e. 2 and 3

8. What reagent enables detection of phenolic hydroxyl?

- a. NaNO_2 (HCl)
- b. $\text{Ag}(\text{NH}_3)_2\text{OH}$
- c. FeCl_3
- d. $\text{Cu}(\text{OH})_2$
- e. -

9. Salicylic acid relates to the phenol acids. Presence of phenolic hydroxyl can be proved by means of reaction with:

- a. CH_3COOH (ice)

- b. CH₃OH (H⁺)
- c. NaOH
- d. H₂SO₄ (concentrated)

e. FeCl₃

10. Choose a reagent for synthesis of acetic acid hydrazide from ethyl acetate:

- a. C₆H₅NHNH₂

b. H₂N-NH₂

- c. H₂N-CH₃

- d. N₃

- e. C₆H₅NH₂

11. A product of complete acetylation of glycerine relates to the following class of organic compounds:

- a. Ether

- b. Acetal

- c. Phenol

d. Ester

- e. Ketone

12. Name a product of ester condensation of acetaldehyde (Tishchenko reaction):

a. Ethyl acetate

- b. Crotonic aldehyde

- c. Acetoacetic aldehyde

- d. Malonic acid

- e. Acetone

13. What reagent helps to distinguish glycerine from ethanol?

a. Cu(OH)₂

- b. HNO₃ (concentrated), in presence of H₂SO₄ (concentrated)

- c. PCl₅

- d. PCl₃

- e. SOCl₂

14. Which of the following cyclic compounds relates to the carbocyclic ones:

- a. Pyridine

- b. Hexane

- c. Furan

- d. Tetrahydrofuran

e. Benzol

15. Ring-opening addition reactions are typical for the following cycloalkane:

- a. Cyclopentane

- b. Cyclohexane

c. Cyclopropane

- d. Methylcyclopentane

- e. Cyclodecane

16. Amino group of p-aminobenzoic acid is involved into reaction with the following reagent:

- a. CH₃COONa

- b. KCN

- c. NH₄OH

- d. NaOH

e. HCl

17. Bromination proceeds with generation of tribromoderivative in presence of the following substituent X:

- a. ? = COOH

- b. ? = CHO

c. ? = SO₃H

d. ? = OH

e. ? = NO₂

18. What is the product of ethyl alcohol-acetic aldehyde reaction?

- a.
- b.
- c.
- d.
- e. -

19. Pyridine can be characterized by reactions of (SE) electrophilic and (SN) nucleophilic substitution. Low reactivity of pyridine in SE reactions is caused by:

- a. Aromatic nature of pyridine nucleus
- b. Hybridization of carbon atoms
- c. Cycle size
- d. Electron-acceptor properties of nitrogen atom
- e. Alkaline properties

20. Choose the carbocation among the given intermediate reactive particles:

- a.
- b.
- c.
- d.
- e.

21. What is the final product of methane chlorination?

- a. Chloroethanol
- b. Chloroform
- c. Tetrachloromethane
- d. Ethane
- e. Chloromethane

22. What compound will be produced as a result of interaction of aniline with nitrite acid?

- a.
- b. -
- c.
- d.
- e.

23. Choose a reagent that can be used for production of propanol-2 out of acetone:

- a. HCOH
- b. H₂ (Ni)
- c. CH₃I
- d. CH₃OH
- e. HCN

24. Choose the reagent that can be used for acetone cyanohydrin production:

- a. H₂N-NH₂
- b. H₂N-OH
- c. HCN
- d. H₂N-NH-C₆H₅
- e. H₂N-CH₃

25. Which reagent allows to distinguish propyne (CH₃-C≡CH) from propene (CH₃-CH=CH₂)?

- a. HCl
- b. Br₂
- c. [Ag(NH₃)₂]OH
- d. Cu(OH)₂

e. Cl2

26. What compound is produced as a result of reaction:

- a.
- b.
- c. CH₃-CH₂-NH-OH
- d. CH₃-NH-CH₂-OH
- e.

27. Galactose belongs to the aldehyde alcohols and similarly to aldehydes interacts with hydrocyanic acid (HCN) according to the following mechanism:

- a. AN
- b. SN2
- c. SR
- d. AE
- e. SN1

28. Identify the succinimide (succinic acid imide) among the given compounds:

- a. H₂NOC-CH₂-CH₂-CH₂-CONH₂
- b.
- c.
- d. H₂NOC-CH₂-CH₂-CONH₂
- e.

29. What reagent enables differentiation of the following pair of compounds?

- a. NaHSO₃
- b. HCN
- c. H₂N-OH
- d. Foelling's reagent**
- e. NH₂-NHC₆H₅

30. For production of phenol ether it is necessary to cause reaction of sodium phenoxide with:

- a. CH₃OH
- b. CH₃NH₂
- c. CH₃C≡N
- d. CH₃Cl**
- e. CH₄

31. Three enumerated test tubes contain solutions of glucose, fructose and starch. What reagent can help to detect fructose?

- a. Fehlings
- b. Lugols
- c. Selivanovs**
- d. Chempure
- e. Tollens

32. Polysaccharide cellulose consists of the remains of the following monosaccharide:

- a. α-D-fructofuranose
- b. β-D-glucofuranose
- c. α-D-glucopyranose
- d. β-D-fructopyranose
- e. β-D-glucopyranose**

33. What class is represented by nitroglycerine medication used for stenocardia treatment?

- a. Nitrogen-containing alcohols
- b. Nitroalkanes
- c. Polyatomic alcohols
- d. Ester**
- e. Ethers

34. Select the correct name for the given compound:

- a. 1,5-Dinitronaphthalene
- b. 4,8-Dinitronaphthalene
- c. 4,9-Dinitronaphthalene
- d. 2,7-Dinitronaphthalene
- e. 1,6-Dinitronaphthalene

35. What of the given compounds makes the reactions of electrophilic substitution (S_E) the easiest?

- a. Chlorobenzene
- b. Toluol
- c. Phenol
- d. Benzaldehyde
- e. Benzene sulfacid

36. Acylated amino group acts as a substituent of the following type:

- a. Type I
- b. Type I and II at the same time
- c. Impossible to determine
- d. Acetanilide does not take part in the S_E reactions
- e. Type II

37. By heating aniline with concentrated sulphuric acid the following compound can be obtained:

- a.
- b.
- c.
- d.
- e.

38. What compound can be synthesized from bromobenzene and bromoethane by Wurtz-Fittigs reaction?

- a. Bromoethyl benzene
- b. Methylbenzene
- c. Ethylbenzene
- d. O-Bromoethyl benzene
- e. P-Diethylbenzene

39. Uric acid is a derivative of:

- a. Pyridine
- b. Purine
- c. Pyrazine
- d. Indole
- e. Pyrazole

40. Specify the reaction product of purine reacting with sodium hydroxide:

- a.
- b.
- c.
- d.
- e.

41. Which of the following reactions is addition reaction?

- a.
- b.
- c.
- d.
- e.

42. The given reaction is called: $C_6H_{12}O_6 \Rightarrow \text{enzymes} \Rightarrow 2C_2H_5OH + 2H_2$

- a. Lactic-acid fermentation of glucose

- b. Glucose reduction
- c. Glucose hydrolysis
- d. Glucose oxidation

e. Alcohol fermentation of glucose

43. What class of reactions does this reaction relate?

- a. Addition
- b. Reduction
- c. Rearrangement
- d. Oxidation
- e. Substitution

44. In order to identify phenol and salicylic acid we use a solution of:

- a. Ferrum chloride (III)
- b. Sodium chloride
- c. Bromine
- d. Sodium hydrogen carbonate
- e. Sodium hydroxide

45. To distinguish between phenol and salicylic acid, the following reagent is used:

- a. Bromine solution
- b. Sodium bicarbonate solution
- c. Sodium hydroxide solution
- d. Iron (III) chloride solution
- e. Sodium chloride solution

46. After the Cannizzaro reaction for benzaldehyde the following compound is obtained:

- a.
- b.
- c.
- d.
- e.

47. Choose a diazonium salt among the given compounds:

- a.
- b.
- c.
- d.
- e.

48. Specify the reaction, through which salicylic acid can be synthesized:

- a.
- b.
- c.
- d.
- e.

49. Ethane is the product of the following reaction:

- a.
- b.
- c.
- d.
- e.

50. This substance can be produced from the calcium carbide. It discolours bromine water and makes metal derivatives. What compound is it?

- a. Acetylene
- b. Ethane
- c. Aniline

- d. Orenol
- e. Ethylene

51. The compound C₇H₈O relates to the derivatives of aromatic hydrocarbons, does not stain with FeCl₃, the product of its oxidation is benzoic acid. What compound is it?

- a. Benzyl alcohol
- b. o-cresol
- c. p-cresol
- d. m-cresol
- e. Methylphenyl alcohol

52. The cause of optical activity is the presence of the following organic compound in the molecular structure:

- a. Asymmetric carbon atom
- b. Triple bond
- c. Plane of symmetry
- d. Functional group
- e. Double bond

53. Alkadiene is a name for aliphatic carbohydrates with double bonds. Choose a general formula for homologous series of alkadienes:

- a. C_nH_{2n-1}
- b. C_nH_{2n-2}
- c. C_nH_{2n}
- d. C_nH_{2n+2}
- e. C_nH_{2n+1}

54. Urea is a derivative of carbonic acid. Choose a denomination of urea:

- a. Ethylic ether of carbamic acid
- b. Monoamide of carbonic acid
- c. Diamide of carbonic acid
- d. Diethylic ether of carbonic acid
- e. Dimethylic ether of carbonic acid

55. Glycosidic (hemiacetal) hydroxyl in a molecule of α -D-glucose pyranose is bonded to the following carbon atom:

- a. C₆
- b. C₁
- c. C₃
- d. C₂
- e. C₄

56. What product is obtained in Wagner reaction during oxidation of alkenes with potassium permanganate in the aqueous medium?

- a. Epoxide
- b. Glycol
- c. Carboxylic acid
- d. Ketone
- e. Aldehyde

57. Which of the listed carbonyl compounds gives a positive iodoform reaction?

- a.
- b.
- c.
- d.
- e.

58. What compound will be produced during reduction of methyl ethyl ketone?

- a. Butanol-1

b. tertiary-butyl alcohol

c. Propanol-2

d. secondary-butyl alcohol

e. Isobutyl alcohol

59. Which of these reactions can be used to identify the primary amino group?

a.

b.

c.

d.

e.

60. The most active component in the aniline acylation reaction is:

a.

b.

c.

d.

e.

61. What medication is formed as a result of interaction of acid with acetic anhydride?

a. Salicyl amide

b. Benzyl salicylate

c. Sodium salicylate

d. Aspirin

e. Phenyl salicylate

62. Specify the number of electrons involved into formation of the isolated conjugated system in the pyrimidine molecule:

a. 2

b. 8

c. 4

d. 10

e. 6

63. Interaction of aniline with excess of bromine water resulted in formation of white precipitate.

What substance was produced?

a. 2,4,6-tribromaniline

b. 2,6-dibromaniline

c. 4-bromaniline

d. 2-bromaniline

e. 2,4-dibromaniline

64. Ethanol can be distinguished from glycerol by the reaction with the following reagent:

a. FeCl₃

b. HBr

c. Cu(OH)₂

d. KMnO₄

e. Ag₂O

65. Dark-violet colour appears, when FeCl₃ solution is added to the following substance:

a.

b.

c.

d.

e.

66. Benzoic acid enters into benzene ring reaction with the following reagent:

a. P₂O₅

b. HNO₃(k) + H₂SO₄(k)

- c. PCl_3
- d. NaOH
- e. NH_3 : t

67. Choose the initial compound for one-stage synthesis of phthalic acid:

- a. 1,2-dichlorobenzene
- b. Salicylic acid
- c. o-xylol
- d. 2-chlorobenzoic acid
- e. m-xylol

68. Interaction of lactic acid with SOCl_2 excess will result in production of the following compound:

- a.
- b.
- c.
- d.
- e.

69. By heating β -hydroxy acids the following substance is formed:

- a. Dicarboxylic acid
- b. Saturated monocarboxylic acids
- c. Lactones
- d. Lactides
- e. Unsaturated carboxylic acids

70. Toluol is converted to the benzoic acid under the following conditions:

- a. Sodium hydroxide action at a room temperature
- b. Boiling in the open air
- c. Heating with sulphuric acid
- d. Hydrogen peroxide action at a room temperature
- e. Oxidation with potassium permanganate

71. Which of the following compounds forms a propionic aldehyde as a result of alkaline hydrolysis ($\text{H}_2\text{O}, \text{OH}^-$)?

- a.
- b.
- c.
- d.
- e.

72. 3-aminopropane acid is included in pantothenic acid which is a component of coenzyme A. What reaction takes place in course of heating of this acid?

- a. Addition
- b. Substitution
- c. Elimination (detachment)
- d. Rearrangement
- e. Reduction

73. General formula of alkynes is $\text{C}_n\text{H}_{2n-2}$. Isomeric alkynes fall into the following compound class:

- a. Alkadienes
- b. Cycloalkanes
- c. Multinuclear arenes
- d. Mononuclear arenes
- e. Alkenes

74. Diphenylmethane can be derived from benzol by means of the following reagent:

- a. CH_2Cl_2
- b. CH_2O
- c. NaNH_2

- d. CH₃COOH
- e. C₂H₅Cl

75. The given reaction is called:

- a. Removal
- b. Regrouping
- c. Esterification
- d. Addition
- e. Acylation**

76. Before nitration of aniline it is usually acidified in order to protect amino groups from oxidation. Which of the following reagents is used for this purpose?

- a. C₂H₅Cl
- b. CH₃CHO
- c. (CH₃CO)₂O**
- d. HNO₂
- e. CHCl₃ + NaOH

77. Choose a generalized reaction that will help to reveal an amino group in the following compounds:

- a. Isonitrile assay**
- b. Azo dye generation
- c. Acylation
- d. Alkylation
- e. Diazotization

78. What type of tautomerism is typical for the given compound?

- a. Cyclo-oxo tautomerism
- b. Carbonyl-enol tautomerism
- c. Nitro-aci-nitro tautomerism**
- d. Amine-imine tautomerism
- e. Keto-enol tautomerism

79. Amides are weak NH-acids. They make salts as a result of interaction with one of the given reagents:

- a. NaNH₂ (Na met.)**
- b. P₂O₅ (to)
- c. LiAlH₄
- d. NaOBr (Br₂ + NaOH)
- e. NaOH (H₂O)

80. Six-membered nitrogen-containing heterocyclic compounds exhibit basic properties. Which compound has the strongest basic properties?

- a. Pyrazine
- b. Pyridazine
- c. Pyridine
- d. Pyrimidine
- e. Piperazine**

81. What denomination corresponds with the given formula?

- a. Benzo [b] pyrone-4
- b. Pyrazinopyrimidine
- c. Benzothiazole
- d. Benzo [b] pyridine**
- e. Imidoazopyrimidine

82. What of the following compounds belongs to ketose representatives?

- a. Iodose
- b. Mannose
- c. Fructose**

- d. Galactose
- e. Talose

83. According to the IUPAC nomenclature the given compound has the following denomination:

- a. 1-propanol
- b. 1-propanethiol
- c. 1,2-propanediol
- d. 1,2,3-propanetriol**
- e. 2-propanol

84. Choose benzo-1,4-diazepine from the given heterocyclic compounds:

- a.
- b.
- c.
- d.**
- e.

85. Reaction of pyruvic acid in which the ketone functional group takes place proceeds with the following reagent:

- a. NaOH
- b. FeCl₃
- c. CH₃OH (H⁺)
- d. HCN**
- e. SOCl₂

86. Oxidation of menthol by potassium dichromate in sulfuric acid (chrome mixture) results in production of:

- a.
- b.
- c.
- d.**
- e.

87. Which of the following compounds has acidophobic properties?

- a. Imidazole
- b. Pyrrole**
- c. Pyridine
- d. Pyrazole
- e. Pyrimidine

88. What reagent can demonstrate presence of an aldehyde group in a furfural molecule?

- a. NaNO₂
- b. (CH₃CO)₂O
- c. [Ag(NH₃)₂]OH**
- d. NH₃
- e. NaOH

89. Which atoms of carbon in the given compound are in the second valence state (sp²-hybridization)?

- a. 1 and 2**
- b. 2 and 3
- c. 5 and 6
- d. 3 and 4
- e. 1 and 3

90. What substances can be derived by alkaline hydrolysis of tripalmitine?

- a. Glycerin and palmitic acid
- b. Glycerin and sodium stearate
- c. Sodium palmitate and water

- d. Sodium palmitate and glycerin
- e. Palmitic acid and sodium hydroxide

91. What is the mechanism of addition reaction of ethanol to acetaldehyde?

- a. AN nucleophylic addition
- b. SE electrophilic addition
- c. SR radical substitution
- d. SN nucleophylic substitution
- e. AE electrophilic addition

92. As a result of sulfonation of naphthalene with concentrated sulfuric acid at a temperature over 160 degrees the following substance is produced:

- a. 2-naphthalensulfonic acid
- b. 3-naphthalensulfonic acid
- c. 5-naphthalensulfonic acid
- d. 4-naphthalensulfonic acid
- e. 1-naphthalensulfonic acid

93. The highest bromination rate will be observed for the following compound:

- a.
- b.
- c.
- d.
- e.

94. Name type of bond between complementary bases:

- a. Semipolar bond
- b. Hydrogen bond
- c. Ionic bond
- d. Covalent π -bond
- e. Covalent σ -bond

95. Choose a name that corresponds to the formula: CH₃-C≡N:

- a. Acetamide
- b. Acetoxime
- c. Ethyl isocyanide
- d. Acetic acid nitrile
- e. Acetic anhydride

96. What kind of isomerism is typical for the oleic acid? CH₃-(CH₂)₇-CH=CH-(CH₂)₇-COOH

- a. Keto-enol tautomerism
- b. Cyclo-oxo tautomerism
- c. Cis-trans-isomerism
- d. Nitro-acid-nitro tautomerism
- e. Lactim-lactam tautomerism

97. Tritane relates to:

- a. Multinuclear arenes with isolated benzene cycles
- b. Mononuclear arenes
- c. Alkenes
- d. Alkanes
- e. Multinuclear arenes with condensated benzene cycles

98. Specify the reagent that allows to produce liquid soap as a result of alkaline fat hydrolysis (saponification):

- a. PbO
- b. NaHCO₃
- c. NaOH
- d. CaO

e. K₂CO₃

99. Natural fats have liquid or solid consistence. What is the main cause of their existence in this or that aggregate state:

- a. Way of production
- b. Ratio of saturated and unsaturated acids**
- c. Molecule sizes
- d. Presence of hydrogen bonds
- e. Molecule solvation

100. Optical isometry can be applied to the following compounds:

- a. Iodine fluorochloromethane (CHIFCl)**
- b. Chloroform (CHCl₃)
- c. Tetrachloromethane (CCl₄)
- d. Dichloromethane (CH₂Cl₂)
- e. Methane (CH₄)

101. Which of the given compounds WILL NOT decolorize the bromine water?

- a. CH₂=CH₂
- b. CH₃-CH=CH₂
- c.
- d. CH₃-CH₃**
- e. CH≡CH

102. Which of the following reactions is required in order to obtain an azo dye out of an aromatic amine?

- a. Salt formation and nitration
- b. Alkylation and nitrosation
- c. Reduction and diazotization
- d. Diazotization and interaction with potassium cyanide
- e. Diazotization and azo compound**

103. Chemically, ethers are quite inert compounds. Ethers decompose even at a room temperature under the effect of the following haloid acid:

- a. HBr
- b. HF
- c. HClO
- d. HI**
- e. HCl

104. Specify the number of existing stereoisomeric aldopentoses:

- a. 2
- b. 6
- c. 16
- d. 8**
- e. 4

105. What is the mechanism of bromination of toluene aromatic nucleus?

- a. AN
- b. SE**
- c. SR
- d. AE
- e. SN

106. This scheme of nitroalkane synthesis is called the reaction of:

- a. Chichibabin
- b. Konovalov**
- c. Kucherov
- d. Zinin

e. Tishchenko

107. Nitrating mixture is a mixture of concentrated acids:

- a. HCl + H₂SO₄
- b. H₃PO₄ + H₂SO₄
- c. HNO₃ + H₂SO₄**
- d. HNO₃ + HCl
- e. H₃PO₄ + HCl

108. Aniline can be converted into water-soluble salt by treatment with a solution of:

- a. Dimethylamine
- b. Hydrochloric acid**
- c. Sodium sulfate
- d. Sodium hydroxide
- e. Ethanol

109. The end product of starch hydrolysis is:

- a. Saccharose
- b. D-fructose
- c. D-glucose**
- d. Maltose
- e. D-galactose

110. What reagent can help to distinguish between starch and glucose?

- a. I₂**
- b. KMnO₄
- c. FeCl₃
- d. K₂Cr₂O₇
- e. Br₂

111. What reagent does p-aminobenzoic acid amino group react with?

- a. NaOH
- b. NH₄OH
- c. HCl**
- d. CH₃COONa
- e. KCN

112. Products obtained from toluene nitriding will mostly consist of:

- a.
- b.
- c.
- d.**
- e.

113. Point out the correct name of product resulting from interaction of acetaldehyde with hydrazine:

- a. Acetaldehyde semicarbazone
- b. Acetaldehyde hydrazone**
- c. Acetaldimine
- d. Acetaldoxime
- e. Acetaldehyde phenylhydrazine

114. What reagent will allow for unsaturated organic compounds reduction under the conditions given below?

- a. NaOH, H₂O
- b. HNO₃, p, t
- c. H₂, Ni, t**
- d. K₂Cr₂O₇, H⁺
- e. H₂O, Hg²⁺, H⁺

115. γ -Butyrolactone is produced during γ -hydroxybutyric acid heating. Point it out among the compounds given below:

- a.
- b.
- c.
- d.
- e.

116. Point out the product of the reaction given below:

- a.
- b.
- c.
- d.
- e.

117. What compound has no carboxyl group but nevertheless is called an acid?

- a. Malic acid
- b. Picric acid
- c. Tartaric acid
- d. Valeric acid
- e. Lactic acid

118. Point out the compound that allows to synthesize acetonitrile $\text{CH}_3\text{-C}\equiv\text{N}$ in one stage.

- a. CH_4
- b. $\text{C}_2\text{H}_5\text{-Cl}$
- c. $\text{C}_6\text{H}_5\text{Cl}$
- d. $\text{CH}_3\text{-I}$
- e. $\text{CH}_3\text{-OH}$

119. What reaction proves acid properties of pyrrole?

- a.
- b.
- c.
- d.
- e.

120. Which of the alcohols given in produces acetone during oxidation?

- a.
- b.
- c.
- d.
- e.

121. Which of the reactions given below is called the Wurtz reaction?

- a.
- b.
- c.
- d.
- e.