Chemistry Entrance Examination Topics

1. General characteristics of the group 6 elements of the main subgroups on the basis of the position in the Periodic table and of atomic structure. Sulfuric acid, its physical and chemical properties. Salt of sulfuric acid. Chemical basis of production of sulfuric acid by the contact method. The use of sulfuric acid.

2. Aniline as a representative of aromatic amines. The structure of the molecule of aniline. Physical and chemical properties of aniline. The mutual influence of the amino group and the benzene nucleus in the molecule of aniline.

3. General characteristics of group 7 elements of the main subgroups on the basis of position in the Periodic table and of atomic structure. Chlorine, its physical and chemical properties, production and application. Chlorine compounds in nature.

4. Glucose, its structure (open and cyclic forms). Physical and chemical properties of glucose. As fructose an isomer of glucose : similarities and differences.

5. General characteristics of the group 6 elements of the main subgroups on the basis of the position in the Periodic table and of atomic structure. Sulfur, its physical and chemical properties. sulfur oxides (IV) and (VI).

6. Amino acids. The structure of molecules, physical and chemical properties. Amphoteric amino acids. Obtaining of amino acids.

7. Chlorine, physical and chemical properties, production and application. Hydrogen chloride and hydrochloric acid, obtaining, physical and chemical properties. Salt of hydrochloric acid. Chlorine compounds in nature.

8. Alkanes. Electronic and spatial structure. Isomerism, nomenclature. Physical and chemical properties.

9. Silicon, physical and chemical properties, production and application. Silicon oxide (4) and silicic acid - obtaining, physical and chemical properties. Silicon compounds in nature.

10. Glucose, the structure of glucose. Physical and chemical properties of glucose. Sucrose is the representative disaccharides. The structure and properties of sucrose.

11. The general characteristics of the elements of group V of the main subgroup on the basis of the positioning in the Periodic system and atom structure. The nitric acid, its physical and chemical properties. The chemical peculiarities of the nitric acid. Nitric acid salts, their properties.

12. Formic and acetic aldehydes. Their physical and chemical properties and obtaining.

13. The general characteristics of the elements of group V of the main subgroup on the basis of the positioning in the Periodic system and atom structure. Phosphorus and its allotropy. The chemical properties of phosphorus. Phosphorus obtaining. Phosphorus compounds in nature.

14. Saturated amines, classification. Molecule structure, physical and chemical properties. The ways of amines obtaining. Amines as organic bases.

15. Water molecule structure. Physical and chemical properties of water. Obtaining of pure water.

16. Ethylene hydrocarbons (alkenes) . Electron and space structure (hybrid type, short connection). Isomerism, nomenclature, ways of obtaining. Physical and chemical properties.

17. The general characteristics of the elements of group IV of the main subgroup on the basis of positioning in the Periodic system and atom structure. Carbon, its allotropy. Chemical properties of carbon.

18. Saturated aldehydes. Homologous series, isomerism, nomenclature. Physical and chemical properties of aldehydes, ways of obtaining. Peculiarities of the formic aldehyde.

19. The characteristics of phosphorus on the basis of positioning in the Periodic system and atom structure. Allotropy. The chemical properties of phosphorus. The orthophosphoric acid: obtaining it, its physical and chemical properties, salts of the orthophosphoric acid.

20. Aniline as the representative of the aromatic amines. The structure of aniline molecules, physical and chemical properties. Reciprical influence of aminogroup and benzol nucleus in aniline molecule.

21. The structure of a nitrogen molecule. Physical and chemical properties, ways of obtaining and use of nitrogen. Ammonium, its physical and chemical properties. Industrial synthesis of ammonium. Use of ammonium. Salts of ammonium. Ammonium hydroxide.

22. Complex esters. Obtaining. Physical and chemical properties.

23. Characteristics of aluminum according to its positioning in the Periodic Table and the structure of the atom. Physical and chemical properties of aluminum.

Amphoterism of aluminum oxide and hydroxide. The use of aluminum and its alloys.

24. Amines. The comparative characteristics of physical and chemical properties of critical and aromatic amines (aniline)

25. Characteristics of iron according to its positioning in the Periodic Table and the structure of the atom. Physical and chemical properties of iron. Iron oxides and hydroxides and the dependence of their properties on the degree of iron oxidation. Iron salts (II) and (III).

26. Fats and their structure. Solid and liquid fats. Physical and chemical properties of fats. Biological significance of fats.

27. General characteristics of the elements of group II of the main subgroup according to their positioning in the Periodic Table and the structure of the atom. Calcium, calcium oxide and hydroxide, their physical and chemical properties, the ways of obtaining and use.

28. Complex esters, the ways of obtaining, physical and chemical properties. The esterification reaction as an example of a reversible reaction; methods of shifting the chemical equilibrium.

29. Characteristics of iron according to its positioning in the Periodic Table and the structure of the atom. Physical and chemical properties of iron. The ways of obtaining and properties of iron compounds (II) and (III)

30. Palmitic, stearic and oleic acids. Specific features of the molecular structure. Physical and chemical properties. Biological significance.

31. Characteristics of calcium on the basis of its position in Periodic table and atomic structure. Physical and chemical properties of calcium, its oxide and hydroxide.

32. Formic and acetic acids- representatives of saturated monoacid carboxylic acids. Obtaining, physical and chemical properties.

33. Position of metals in Periodic table. General physical and chemical characteristics of metals. The main methods of obtaining of metals and alloys in industry.

34. Homologous series of saturated aldehydes. Structure of carbonyl group. Isomerism, nomenclature. Physical and chemical properties. Peculiarities of formic aldehyde.

35. Metals and alloys in up-to-date industry. The main ways of generation of metals and alloys. General physical and chemical properties of metals.

36. Acetic Acid. The structure of the molecule, obtaining, physical and chemical characteristics.

37. General characteristics of alkali metals on the basis of their position in Periodic table and atomic structure. Physical and chemical properties of alkali metals. Obtaining of alkali metals.

38. Homologous series of saturated aldehydes. The structure of carbonyl group, isomerism, nomenclature. Ways of obtaining. Physical and chemical properties.

39. Oxides as the most important class of inorganic compounds. Classification of oxides. Methods of production; physical and chemical properties.

40. Amino acids; structure, physical and chemical properties. Principal pathway of synthesis of α-amino acids.

41. Salts as one of most important class of inorganic compounds. Classification of salts. Methods of production; physical and chemical properties.

42. Carboxylic acids. Nomenclature, isomerism, physical and chemical properties. Hydrogen bond and its influence on the properties of carboxylic acids.

43. Genetic relation between oxides, hydroxides, acids, salts. Equations of reactions in molecular and ionic forms.

44. Homologous series of saturated aldehydes. Structure of carbonyl group. Isomerism, nomenclature. Physical and chemical properties on an example of formaldehyde and acetaldehyde. Production of formaldehyde and acetaldehyde.

45. Acids as one of most important classes of inorganic compounds. Classification of acids, methods of production, physical and chemical properties.

46. Ethanol, structure of hydroxyl group, acidic properties. Hydrogen bond and its influence on physical properties of ethanol. Chemical properties, production and application of ethanol.

47. Theory of electrolytic dissociation. Electrolytes and non-electrolytes. Mechanisms and causes of dissociation. Degree of dissociation. Strong and weak electrolytes.

48. Polyatomic alcohols (ethylene glycol,glycerol). Structure of their molecules. Physical and chemical properties.

49. Acids – the most important class of inorganic composition. Classification of acids, methods of acids production, physical and chemical properties.
50. Alkenes. Electronic and spatial structure (type of hybridization, multiple bond). Isomerism, nomenclature. Physical and chemical properties by the example of ethane and propene. Markovnikov's rule.

51. Solutions, classification of solutions. Solubility of substances in water. Heat conditions during solubility. Crystallohydrates. Quantitative expression of solubility: coefficient of solubility and concentration.

52. Homologous range of saturated monoatomic spirits. Isomerism, nomenclature. The structure of hydroxyl group. Hydrogen bond and its influence on physical properties of spirits. Chemical properties. Production of methanol and ethanol.

53. Chemical bond. Covalent polar and non polar bond. Exchange and donor-acceptor mechanism of covalent bond formation (examples). The properties of covalent bond.

54. Acetylene, its electronic and spatial structure (type of hybridization, multiple bond), physical and chemical properties, production and use.

55. General description of alkali metals based on Periodic system and atomic structure. Physical and chemical properties of alkali metals. Production of alkali metals.

56. Aromatic hydrocarbons. Electronic and spatial structure by the example of benzol. Toluol. Physical and chemical properties. Mutual influence of methyl group and benzene nucleus in toluol molecule.

57. General description of elements from the 5th group of the main subgroup based on Periodic system and atomic structure. The most significant nitrogen combinations, ammonia, ammonia salts, nitric acid, nitrates. Their industrial production.

58. Homologous range of saturated monoatomic spirits. Hydrogen bond and its influence on physical properties of spirits. The structure of hydroxyl group. Chemical properties of spirits.

59. The structure of the electron shells of the II and III period chemical elements of the Periodic system. Change of the properties of chemical elements in groups and periods in terms of the ideas about the atomic structure.

60. Phenol. Physical and chemical properties of phenol. Mutual influence of the hydroxyl group and the benzene ring in the phenol molecule. Production of phenol in industry.

61. Hydrogen. The chemical and physical properties of hydrogen. Production of hydrogen in industry and laboratory. The usage of hydrogen.

62. Ethanol, the structure of hydroxyl group. Hydrogen bond and its influence on the physical properties of ethanol. Chemical properties. Production of ethanol.

63. The modern formulation of the Periodic law. Change of the properties of elements in groups and periods in terms of the ideas about the atomic structure.

64. Hydrocarbons of acetylene series (alkynes). The electronic and spatial structure (hybridization type, multiple bond). Isomery, nomenclature. Physical and chemical properties of acetylene.

65. Chemical bond. Hybridization of the valence orbitals in the formation of a covalent bond on the example of methane, ethene, ethyne.

66. Benzene. The electronic and spatial structure, physical and chemical properties. Homologues of benzene.

67. General characteristics of elements of group VI of the main subgroup based on the position in the Periodic system and atomic structure. Oxygen. Allotropy of oxygen. Physical and chemical properties of oxygen. Production of oxygen in industrial and laboratory conditions. The usage of oxygen.

68. Homologous series of monoatomic saturated alcohols. Isomery, nomenclature. The structure of the hydroxyl group. Hydrogen bond and its influence on the physical properties of alcohols. The chemical properties of alcohols.

69. Salts as the most important class of inorganic compounds. Classification of salts, methods of preparation, physical and chemical properties.

70. Aromatic hydrocarbons. Benzene, electronic and spatial structure, physical and chemical properties. Application.

71. Silicon. Preparation, physical and chemical properties of silicon. Silicon oxide (IV) and silica acid - the physical and chemical properties. Silicon compounds in nature.

72. Ethane and ethene - comparative characteristics of chemical properties.

73. Carbon. Allotrope of carbon. The chemical properties of carbon. Carbonic acid, properties. Salts of carbonic acid.Nucleic acids structure and their role for the cell.

74. Aromatic hydrocarbons (benzene and its homologues). Their electronic and spatial structure, physical and chemical properties.
75. Solutions, classification of solutions. The solubility of substances in water. Thermal phenomena during dissolution. Crystalline hydrates. Quantitative expression of solubility: solubility coefficient and concentration.

76. Homologous series of alkenes and alkynes. Comparative characteristics of their chemical properties.

77. Chemical bond. Covalent polar and non-polar bond. The exchange and the donor-acceptor mechanisms of covalent bond formation (examples). Properties of the covalent bond.

78. The alcohols and phenols. Comparative characteristics of their chemical properties.

79. Ionic exchange reactions. Reversibility of chemical reactions. Chemical balance and conditions of its shift.

80. A homological number of acetylene (alkynes). Isomerism. Nomenclature.

81. Classification of chemical reactions in inorganic and organic chemistry. Examples.

82. Phenol. Physical and chemical properties of phenol. Mutual influence of the hydroxyl group and a benzene nucleus in a phenol molecule. Phenol obtaining in the industry.

83. The bases - the most important class of inorganic compounds. Classification of the bases, ways of obtaining, physical and chemical properties. Organic bases.

84. Acetylene hydrocarbons - (alkynes). Electronic and spatial structure (hybridization type, multiple link). Isomerism. Nomenclature. Physical and chemical properties of acetylene, its industrial extraction.

85. Classification of chemical reactions in inorganic chemistry. Redox reactions. Examples.

86. Saturated amines, classification. Structure of molecules. Analogy in properties of ammonia and amines. Amines - organic bases. Physical and chemical properties of amines.

87. The bases - the most important class of inorganic compounds. Classification of the bases, ways of obtaining, physical and chemical properties. Alkali, obtaining and properties. Ammonium hydroxide.

88. Ethylene hydrocarbons (alkenes). Electronic and spatial structure (hybridization type, multiple link). Isomerism, nomenclature. Physical and chemical properties. Ways of obtaining.

89. The theory of electrolytic dissociation. Electrolytes and non-electolytes. Strong and weak electrolytes. The degree of dissociation. Mechanisms and causes of dissociation.

90. Aliphatic monoatomic alcohols and monoatomic alcohols. Comparative analysis of physical and chemical properties.

91. Oxides as the main class of inorganic compounds. Classification. The methods of obtaining oxides. Physical and chemical properties.

92. Aliphatic amines. Classification. The structure of aminogroup. Physical and chemical properties. Amines as organic compounds.

93. Genetically relationship of classes: hydroxides, acids, salts. Provide the molecular and ionic equations.

94. Alkenes. Electron and space structure (hybridization type, multiple linkage). Isomerism, nomenclature.The methods of obtaining alkens.Physical and chemical properties. Markovnikov's law.

95. Reversibility of chemical reactions. Chemical equilibrium and displacement. Ionic reactions.

96. Homologous range of aliphatic monobasic carboxylic acids. Isomerism, nomenclature. The methods of obtaining. Hydrogen bond and its effect on the phusical properties of carbonic acids. Chemical properties.

97. Atomic theory in chemistry. Relative molecular and atomic mass. Mass conservation law and its significance in chemistry. Avogadro's law. Molar volume.

98. Homologous alkane series. Electron and space structure of alkanes. Isomerism, nomenclature. Physical and chemical properties.