University of Warmia and Mazury in Olsztyn
School of Medicine

Medical School Admission Test sample:

CHEMISTRY

1. **Principal quantum number describes:**
   a) total orbital energy
   b) orbital shape
   c) magnitude and shape of an orbital
   d) number of electrons in an atom
   e) number on valence electrons in an atom

2. **The description [Ar] $3d^1$ $4s^2$ shows the electron configuration of the atom:**
   a) potassium
   b) calcium
   c) chromium
   d) manganese
   e) scandium

3. **Comparing the energy of bond σ and bond π one can state that the energy of σ bond is:**
   a) equal to the energy of π bond
   b) lower than the energy of π bond
   c) higher than the energy of π bond
   d) equal half of the energy of π bond
   e) equal one fourth of the energy of π bond

4. **In an ethene molecule between carbon atoms there are:**
   a) two σ bonds and four π bonds
   b) one σ bond and five π bonds
   c) six σ bonds
   d) five σ bonds and one π bond
   e) four σ bonds and two π bonds

5. **Double and triple bonds comprise of bonds:**

	double bond	triple bond
a)	one σ and two π	three π
b)	two π	one σ and two π
c)	two σ	one σ and two π
d)	one σ and one π	one σ and two π
e)	one σ and two π	one σ and three π

6. Indicate the set of molecules in which π bonds are present:

a) C_2H_2, CO_2, CH_4
b) C_2H_2, O_2, CH_4
c) C_2H_4, H_2, CO_2
d) C_2H_2, CO_2, N_2
e) C_2H_4, Cl_2, CO_2

7. Graphite and diamond are to each other:

a) isotopes
b) isotopes and allotropes
c) isomers and allotropes
d) allotropes
e) enantiomers and allotropes

8. In which group of compounds is the hydrogen bond present:

a) alcohols, hydrocarbons, carbon tetrachloride
b) peptides, liquid nitrogen, alcohols
c) peptides, liquid nitrogen, liquid hydrocarbons
d) alcohols, carbon tetrachloride, liquid nitrogen
e) peptides, benzene, alcohols

9. Indicate the set of basic oxides:

a) K_2O, CO, Cs_2O, BaO
b) K_2O, CO_2, CO, CuO
c) K_2O, SO_2, SiO_2, BaO
d) K_2O, SiO_2, FeO, Na_2O
e) K_2O, CaO, Cs_2O, BaO

10. In standard conditions 5,6 g of carbon dioxide occupies a volume of:

a) 11.2 dm^3
b) 6.8 dm^3
c) 5.6 dm^3
d) 3.4 dm^3
e) 2.8 dm^3

11. The dissociation constant of ammonia is 1.8×10^{-5} therefore the dissociation ratio in an ammonia solution in concentration 0.01 mol x dm^{-1} is:

a) 42%
b) 4.2%
c) 0.42%
d) 0.042%
e) 0.0042%

12. Solid potassium hydroxide moistens on air and melts after a while. This is because potassium hydroxide:

a) sublimes
b) easily absorbs oxygen from air
c) has a low melting point
d) associates
e) is a hygroscopic substance

13. To a solution containing 10 g of NaOH was added 200 g of 10% solution of HNO_3. After the reaction in solution were present:

a) Na^+, NO_3^-, H_2O
b) Na^+, NO_3^-, OH^-, H_2O
c) Na^+, NO_3^-, H^+, H_2O
d) H^+, NO_3^-
e) Na^+, NO_3^-

14. The solubility of $NaNO_3$ in water at a temperature of 100^oC equals 180 g. The mass percentage of saturated solution at this temperature equals:

a) 80
b) 64
c) 50
d) 36
e) 25

15. 0.5 mole of $Na_2SO_4 \times 10\ H_2O$ consists of:

a) 6.02×10^{23} molecules of Na_2SO_4 and 6.02×10^{24} molecules of H_2O
b) 6.02×10^{22} molecules of Na_2SO_4 and 3.01×10^{23} molecules of H_2O
c) 6.02×10^{24} molecules of Na_2SO_4 and 6.02×10^{23} molecules of H_2O
d) 3.01×10^{23} molecules of Na_2SO_4 and 3.01×10^{24} molecules of H_2O
e) 3.01×10^{24} molecules of Na_2SO_4 and 3.01×10^{23} molecules of H_2O

16. Sodium colors flame:

a) carmine
b) pink-violet
c) blue
d) green
e) yellow

17. Indicate an equation representing redox process:

a) $H_2O + SO_2 \rightarrow H_2SO_3$
b) $CaO + H_2O \rightarrow Ca(OH)_2$
c) $KOH + HNO_3 \rightarrow KNO_3 + H_2O$
d) $CaO + SO_2 \rightarrow CaSO_3$
e) $Mg + 2HCl \rightarrow MgCl_2 + H_2\uparrow$

18. Indicate the oxidation number of sulfur in following compounds:

	H_2S	K_2SO_3	$Al_2(SO_4)_3$
a)	-II	+IV	+VI
b)	+II	+IV	+VI
c)	+II	+VI	+IV
d)	-II	+VI	+IV
e)	+II	+II	+IV

19. Indicate the oxidant and reductant in the reaction shown below:

$Ag + 2HNO_3 \rightarrow AgNO_3 + NO_2 + H_2O$

	oxidant	reductant
a)	silver atoms	nitrate anion
b)	nitrate anion	hydrogen cation
c)	nitrate anion	silver atoms
d)	hydrogen cation	nitrate anion
e)	nitrate anion	nitrate anion

20. Indicate the compound with the highest oxidation number of carbon atom:

a) CH_4
b) HCOOH
c) CO
d) CH_3OH
e) H_2CO_3

21. A xantoproteic reaction is used to detect:

a) starch
b) fats
c) proteins
d) presence of π bonds in molecules
e) amides

22. One of the nitrogen oxides contains 29,5% of nitrogen. This oxide is:

a) NO
b) N_2O_5
c) NO_2
d) N_2O
e) N_2O_3

23. Indicate the product of gentle oxidation of 2-methylpropan-1-ol:

a) 2-methylpropanone
b) ethyl methyl ketone
c) 2-methylpropanal
d) propanone
e) butanone

24. The chemical equation shown below describes a reaction of:

$Cl_2 + H_2O \rightarrow HClO + HCl$

a) addition
b) disproportionation
c) substitution
d) elimination
e) neutralization

25. Polyvinyl chloride is obtained in the process of:

a) polymerization of CH_2-CH_2
b) polymerization of CHCl=CHCl
c) polycondensation of CHCl=CHCl
d) polycondensation of CH_2=CHCl
e) polymerization of CH_2=CHCl

26. To the group of most toxic metals belong:

a) lead, mercury and cadmium
b) lead, sodium and magnesium
c) lead, potassium and magnesium
d) calcium, sodium and magnesium
e) calcium, mercury and magnesium

27. The methanol – water system is a:

a) two-component and two-phase system
b) two-component and one-phase system
c) one-component and one-phase system
d) one-component and two-phase system
e) two-component and three-phase system

28. To an open vessel with hydrochloric acid magnesium was added. As an effect of resulting processes:

a) the mass of the system will increase
b) only an exchange of energy between the system and the environment will occur
c) only the exchange of mass between the system and the environment will occur
d) the mass of the system will decrease
e) the mass of the system will remain unchanged

29. Hess's law applies to:

a) some chemical transformations
b) all chemical transformations
c) only synthesis processes
d) all chemical transformations with the stipulation of stability of pressure or volume
e) all chemical transformations but the system can perform any work

30. On the basis of data shown below indicate the enthalpy of sublimation of 1 mole of iodine:

$$H_{2\,(g)} + I_{2\,(s)} \rightarrow 2HI_{(g)} \quad \Delta H_1 = 52\ kJ$$
$$H_{2\,(g)} + I_{2\,(g)} \rightarrow 2HI_{(g)} \quad \Delta H_1 = -\ 10\ kJ$$

a) – 20 kJ
b) – 52 kJ
c) 42 kJ
d) – 62 kJ
e) 62 kJ

31. The standard change of energy of transformation ΔU^o is equal to the amount of energy exchanged as heat by the system in conditions :

a) isothermal
b) isobaric
c) isochoric
d) isobaric and isochoric
e) isothermal and isobaric

32. Enthalpy does not depend on the:

a) initial state of a system
b) final state of a system
c) kind of substrates
d) way of performing a reaction
e) type of chemical reaction

33. How much aluminum will separate on the cathode if 10 kg of aluminum oxide is electrolyzed:

a) 10.6 kg
b) 8.2 kg
c) 5.3 kg
d) 5.1 kg
e) 4.5 kg

34. The final product of anodic process in aluminum production is:

a) oxygen
b) a mixture of carbon oxide and carbon dioxide
c) carbon oxide
d) carbon dioxide
e) hydrogen

35. Products of electrolysis of water solution of potassium chloride are:

a) K, Cl_2 and KOH
b) H_2, Cl_2 and KOH
c) H_2, O_2 and KOH
d) O_2, Cl_2 and KOH
e) K, H_2 and O_2

36. The standard electrode potential of half-cells are characteristic for system:

a) metal-metal
b) cation-metal-metal cation
c) metal-metal anion
d) anion of non-metal – anion of nonmetal
e) metal – metal cation

37. Electrodes made of active metals such as magnesium, zinc or aluminum connected with steel constructions protect from corrosion. Such electrodes are called:

a) corrosion inhibitors
b) electrolytic coatings
c) corrosion catalysts
d) protectors
e) metallic coating

38. Hg, Hg,Cl_2| Cl electrode is:

a) halogen
b) calomel
c) red-ox
d) primary
e) chloride

39. An oxidation-reduction electrode is a:

a) copper electrode
b) hydrogen electrode
c) zinc electrode
d) bromine electrode
e) platinum in solution of salts of iron(II) and iron(III)

40. Zinc and graphite are electrodes in a:

a) Daniell cell
b) Volty cell
c) Leclanchy cell
d) Planty cell
e) Edison cell

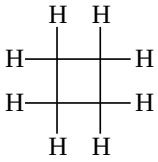
41. Basic components of gasoline (petrol) are hydrocarbons composed of chains constructed with:

a) 1 to 4 carbon atoms
b) 3 to 8 carbon atoms
c) 1 to 8 carbon atoms
d) 8 to 16 carbon atoms
e) 5 to 12 carbon atoms

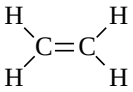
42. Passing propene through a solution of potassium permanganate one obtains:

a) propane
b) propane-1-ol
c) acetaldehyde
d) propane-1,2-diol
e) propane-2,3-diol

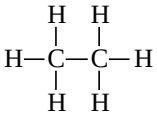
43. In which of the hydrocarbons shown below has the carbon atom a *sp* hybridization state:



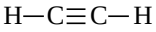
a)



b)



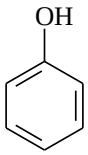
c)



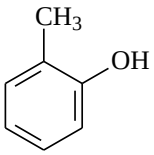
d)

e)

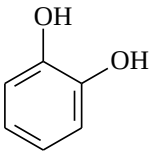
44. Which of the compounds shown below belong to phenols?



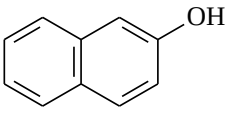
I



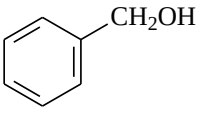
II



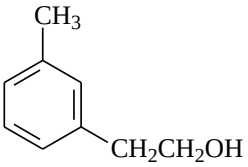
III



IV



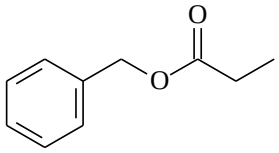
V



VI

a) I, II
b) only I
c) I, II, III, IV
d) I, II, IV
e) V and VI

45. Organic compound shown below is an/a:



a) ester of propionic acid and phenylmethanol
b) ester of propionic acid and phenol
c) ester of benzoic acid and propanol
d) aliphatic-aromatic ketone
e) lactone

46. Which compounds described by semi-structural formulas below belongs to a class of aldoses?

a) CHO-CHOH-CH_2OH
b) CH_3-CO-CH_3
c) CH_2OH-CHOH-CH_2OH
d) CHO-CH_2-COOH
e) CH_2OH-CO-CH_2OH

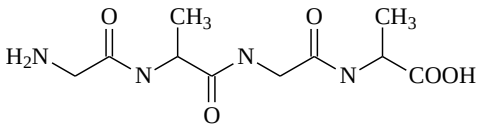
47. Sorbitol

CH_2OH
|
$(CHOH)_4$
|
CH_2OH

is obtained from glucose in the reaction of:

a) oxidation
b) neutralization
c) hydrolysis
d) reduction
e) substitution

48. The compound show below can be described with the abbreviation:



a) Gly-Ala-Gly-Ala
b) Ala-Gly-Ala-Gly
c) Gly-Gly-Ala-Ala
d) Ala-Ala-Gly-Gly
e) Gly-Ala-Ala-Gly

49. What is the name of the process occurring when a protein is treated with alcohol at room temperature:

a) condensation
b) estrification
c) peptization
d) denaturation
e) renaturation

50. A nucleotide is a combination of:

a) base-sugar-phosphoric acid
b) base-sugar
c) sugar-phosphoric acid
d) base-phosphoric acid
e) amino acid-sugar-phosphoric acid