

1. What reagent should be chosen in order to detect presence of Ca^{2+} cation in a solution?

a. $(\text{NH}_4)_2\text{C}_2\text{O}_4$

b. HNO_3

c. NaBr

d. KCl

e. HCl

2. Oxidizing properties of free halogens increase in the following group:

a. Cl_2 , F_2 , I_2 , Br_2

b. F_2 , Cl_2 , Br_2 , I_2

c. I_2 , Br_2 , Cl_2 , F_2

d. Br_2 , F_2 , I_2 , Cl_2

e. I_2 , Cl_2 , Br_2 , F_2

3. Name a complex compound that has antitumoral activity:

a. $[\text{Cu}(\text{NH}_3)_4(\text{SCN})_2]$

b. $\text{K}_2\text{Na}[\text{Co}(\text{NO}_2)_6]$

c. $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{Cl}_2$

d. $\text{Na}_4[\text{Sn}(\text{OH})_3\text{Cl}_3]$

e. $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$

4. What reaction is applied for detection of Fe^{3+} cation?

a. Hydrolysis

b. Precipitation

c. Complexing

d. Neutralization

e. Reduction

5. Hydrogen is characterized by the following oxidation rates: -1; 0; +1. The -1 oxidation rate hydrogen has in:

a. Hydroxides

b. Acids

c. Hydrides

d. Water

e. Acid salts

6. Silver nitrate is used in ophthalmology as an antibacterial and anti-inflammatory agent. AgNO_3 can be produced as a result of interaction between the following substances:

a. $\text{Ag} + \text{HNO}_3$

b. $\text{Ag} + \text{KNO}_3$

c. $\text{AgCl} + \text{NaNO}_3$

d. $\text{Ag}_2\text{O} + \text{KNO}_3$

e. $\text{AgCl} + \text{NH}_4\text{NO}_3$

7. Choose a non-salt-forming oxide from the following compounds:

a. Na_2O

b. N_2O

c. P_2O_5

d. CuO

e. SO_3

8. What substance can act as both oxidant and reducer in oxidation-reduction reactions?

a. CrO_3

b. SO_2

c. CO_2

d. SO_3

e. PbO_2

9. Nitrogen (I) oxide (N_2O) is applied for inhalation narcosis. It is obtained by heating of:

- a. NH_4OH
- b. NaNO_3
- c. NH_3
- d. $\text{Cu}(\text{NO}_3)_2$
- e. NH_4NO_3**

10. Calcium hydrogen sulphide hexahydrate is often used in the cosmetological practice. Specify the formula of this salt:

- a. $\text{CaSO}_3 \cdot 6\text{H}_2\text{O}$
- b. $\text{CaS} \cdot 6\text{H}_2\text{O}$
- c. $\text{Ca}(\text{HS})_2 \cdot 6\text{H}_2\text{O}$**
- d. $\text{Ca}(\text{HSO}_3)_2 \cdot 6\text{H}_2\text{O}$
- e. $\text{CaSO}_4 \cdot 6\text{H}_2\text{O}$

11. Qualitative reaction for determination of Cr(VI) compounds is origination of chromium oxide-diperoxide that stains ether layer with blue. What is formula of this chromium compound?

- a. NaCrO_2
- b. CrO_5**
- c. Cr_2O_3
- d. CrO_3
- e. CrO

12. What is molecular weight of a gas if its hydrogen density is 15?

- a. 60 g/mole
- b. 30 g/mole**
- c. 15 g/mole
- d. 7,5 g/mole
- e. 45 g/mole

13. Specify the complexing agent for a complex compound $\text{K}_2[\text{HgI}_4]$:

- a. $\text{K}_2[\text{HgI}_4]$
- b. Hg_2^{2+}**
- c. I^-
- d. K^+
- e. HgI_4^{2-}

14. Qualitative determination of the following compound is accompanied by blue stain of the ether layer:

- a. Cl_2
- b. MnSO_4
- c. FeSO_4
- d. H_2O_2**
- e. Na_2HPO_4

15. Diluted solution of hydrochloric acid was added to a solution under examination. This resulted in origin of white caseous deposition. This is the evidence of presence of following ions:

- a. Iron (II)
- b. Ammonium
- c. Silver**
- d. Barium
- e. Iodine

16. Which of the following oxides is the anhydride of nitric acid?

- a. NO
- b. NO_2
- c. N_2O_5
- d. N_2O_4
- e. N_2O_3**

17. Sodium nitrite is used in medicine as a vasodilating drug against stenocardia. NaNO_2 acts as reducer with the following compound:

- a. KI
- b. NaHCO_3
- c. H_2S
- d. NH_3
- e. KMnO_4**

18. Presence of arsenic in the raw material used in pharmaceutical production can be detected by means of Marsh test. During the test the compound of arsenic with hydrogen is produced. What is the oxidation number of arsenic in this compound?

- a. -3**
- b. +5
- c. +1
- d. -5
- e. +3

19. Iron (II) sulfate is a part of drugs used in treatment of iron deficiency anemia. FeSO_4 enters into reaction with one of the following compounds:

- a. FeCl_2
- b. NaCl
- c. HCl
- d. CO_2
- e. KMnO_4**

20. Choose the most stable complex ion on the ground of values of instability constants:

- a. $[\text{Fe}(\text{CN})_6]^{3-}$ $K_{\text{H}} = 1.1 \cdot 10^{-31}$**
- b. $[\text{Ag}(\text{NH}_3)_2]^+$ $K_{\text{H}} = 5.8 \cdot 10^{-8}$
- c. $[\text{Co}(\text{NH}_3)_6]^{2+}$ $K_{\text{H}} = 4.0 \cdot 10^{-5}$
- d. $[\text{Ni}(\text{CN})_4]^{2-}$ $K_{\text{H}} = 1.1 \cdot 10^{-22}$
- e. $[\text{Ag}(\text{CN})_2]^-$ $K_{\text{H}} = 1.1 \cdot 10^{-21}$

21. Which of the following formulas corresponds to the electronic configuration of Cu atom?

- a. $[\text{Ar}] 3d^7 4s^2$
- b. $[\text{Ar}] 3d^{10} 4s^1$**
- c. $[\text{Ar}] 3d^6 4s^2$
- d. $[\text{Ar}] 3d^9 4s^2$
- e. $[\text{Ar}] 3d^8 4s^2$

22. Presence of which ion of d-elements in the solutions can be detected by means of $\text{K}_4[\text{Fe}(\text{CN})_6]$?

- a. Zn^{2+}
- b. Fe^{2+}
- c. Fe^{3+}**
- d. Cr^{3+}
- e. Cu^{2+}

23. Change of acid-base properties in the compounds MnO MnO_2 Mn_2O_7 answers to the following regularity:

- a. -
- b. Acidic properties become stronger**
- c. Acid-base properties stay unchanged
- d. Basic properties become stronger
- e. Acidic properties diminish

24. What gas is produced as a result of interaction of concentrated nitric acid with sulphur?

- a. H_2
- b. N_2O

c. NH_3

d. NO_2

e. N_2

25. Which electronic configuration of valence electrons is corresponding to an element of the 4th period, VI group, main subgroup?

a. $6s^2 5d^2$

b. $3s^2 3p^4$

c. $4s^1 3d^5$

d. $6s^2 6p^2$

e. $4s^2 4p^4$

26. According to the mass action law, velocity of process $2\text{SO}_2(\text{g}) + \text{O}_2(\text{g}) = 2\text{SO}_3(\text{g})$ is expressed as:

a. $k [\text{SO}_2] + [\text{O}_2]$

b. $[\text{SO}_2]^2 + [\text{O}_2]$

c. $[2\text{SO}_2] \times [\text{O}_2]$

d. $k [\text{SO}_2] \times [\text{O}_2]$

e. $k [\text{SO}_2]^2 \times [\text{O}_2]$

27. An acid was added to the solutions of the given salts. In what case does the gas emission take place?

a. Na_2SiO_3

b. $\text{Ca}_3(\text{PO}_4)_2$

c. K_2SO_4

d. CuSO_4

e. Na_2CO_3

28. In oxidation-reduction reactions potassium permanganate KMnO_4 acts only as an oxidizer. When the reaction takes place in the acidic medium, the crimson solution becomes discoloured. Specify the product of MnO_4^- -ion reduction in the acidic medium:

a. MnO_2

b. $[\text{Mn}(\text{OH})_2]$

c. $[\text{Mn}(\text{OH})_4]$

d. Mn^{2+}

e. MnO_4^{2-}

29. Chlorophyll, the green pigment of plants, is a chelate compound. Specify the chelating ion in the chlorophyll:

a. Mn^{2+}

b. Fe^{3+}

c. Mg^{2+}

d. Fe^{2+}

e. Ni^{2+}

30. Potassium dichromate $\text{K}_2\text{Cr}_2\text{O}_7$ is applied as oxidant in acidic medium. What is the product of reduction of dichromate-ion $\text{Cr}_2\text{O}_7^{2-}$ under these conditions?

a. Cr_2O_3

b. Cr^{3+}

c. $\text{Cr}(\text{OH})_2$

d. $\text{Cr}(\text{OH})_3$

e. $[\text{Cr}(\text{OH})_6]^{3-}$

31. When copper (II) hydroxide enters into reaction with alkali, complex compounds are produced. What is the coordination number of copper in such compounds?

a. 5

b. 3

c. 2

d. 4

e. 6

32. What of the following metals displaces hydrogen from hydrochloric acid?

a. Mercury

b. Copper

c. Aluminium

d. Aurum

e. Platinum

33. Hybridization of one s- and 2 p-orbitals leads to formation of three sp²-hybrid orbitals. Specify the angle between these orbitals:

a. 120°

b. 109°

c. 104,5°

d. 90°

e. 180°

34. Which element has the same valence in both hydrogen compound and higher oxide?

a. Carbon

b. Selenium

c. Argon

d. Bromine

e. Phosphorus

35. In order to determine CO₂ in air the following substance can be applied:

a. Crystalline NaOH

b. Water solution Ca(OH)₂

c. CaO

d. Water solution NaOH

e. Fe(OH)₂

36. To prepare 50 g of hypertonic sodium chloride solution with mass concentration 10% it is necessary to take:

a. 25 g of NaCl

b. 50 g of NaCl

c. 0,5 g of NaCl

d. 1 g of NaCl

e. 5 g of NaCl

37. For quantitative determination of some drugs the solutions of sulfuric and perchloric acids are applied. Which of the following oxides are the anhydrides of these acids?

a. SO₂, Cl₂O

b. SO₂, Cl₂O₇

c. SO₂, Cl₂O₇

d. SO₃, Cl₂O₇

e. SO₃, ClO₂

38. Heme (a constituent part of hemoglobin) is a complex iron compound. It relates to the following type of complex compounds:

a. Chelate complex

b. Aquacomplex

c. Hydroxocomplex

d. Cationic complex

e. Acidocomplex

39. The 0,1 M solution of which substance has the smallest ion concentration?

a. H₂SO₄

b. NaNO₃

- c. HCl
- d. CaCl_2

e. CH_3COOH

40. Which compound was generated due to nonpolar covalent type of chemical bond?

- a. KI
- b. H_2S
- c. KCl
- d. NH_4Cl

e. H_2

41. In order to prepare 1 L of 0,1 M solution of sulfuric acid ($M(\text{H}_2\text{SO}_4) = 98 \text{ g/mole}$) it is necessary to take:

- a. 980 g of NaCl
- b. 49 g of NaCl
- c. 98 g of NaCl

d. 9,8 g of H_2SO_4

e. 0,098 g of NaCl

42. Which of the given bases is a weak electrolyte?

- a. NaOH
- b. KOH
- c. $\text{Ca}(\text{OH})_2$
- d. $\text{Ba}(\text{OH})_2$

e. $\text{Mg}(\text{OH})_2$

43. Ions of which chemical element have an impact on the electrolytic balance of cerebral tissues. What salt of this element is used for treating the psychic disorders?

- a. Cl, NaCl
- b. Ca, CaCl_2
- c. Mg, MgSO_4

d. Li, Li_2CO_3

e. I, KI

44. What salt does the expression $K_r = K_w / K_a$ for hydrolysis constant correspond with?

a. $\text{CH}_3\text{COONH}_4$

b. NaCN

- c. $(\text{NH}_4)_2\text{SO}_4$
- d. Na_2SO_4
- e. $(\text{NH}_4)_3\text{PO}_4$

45. If concentrated HNO_3 interreacts with copper, it can be reduced to the following compound:

a. NH_4NO_3

b. NO_2

- c. N_2O
- d. NO
- e. N_2

46. Manganese and chlorine demonstrate the most similar properties when they have the following oxidation number:

a. +7

- b. 0
- c. +2
- d. +4
- e. +3

47. What is the molecular weight of an undefined gas knowing that its density is 20 relative to the density of hydrogen?

a. 50 g/mole

b. 40 g/mole

c. 20 g/mole

d. 10 g/mole

e. 30 g/mole

48. How much sodium hydroxide is required to prepare 500 g of 10% sodium hydroxide solution?

a. 50 g

b. 5 g

c. 25 g

d. 10 g

e. 0,5 g

49. Solution of 0,1 M of the following acid has the highest concentration of hydrogen ions:

a. H_2CO_3

b. HCN

c. HCl

d. CH_3COOH

e. H_2SO_3

50. What is oxidation number of the central atom in the compound $\text{H}[\text{AuCl}_4]$?

a. +2

b. +4

c. 0

d. +1

e. +3

51. When chlorine is passed through the cold solution of potassium hydroxide the following compound are produced:

a. KCl, KClO, H_2O

b. KCl, H_2O

c. KClO_3 , H_2O

d. KClO_3 , KClO, H_2O

e. KCl, KClO_2 , H_2O

52. Specify the molecular formula of the oxide whose conjugate is permanganic acid:

a. Mn_2O_7

b. Mn_2O_3

c. MnO

d. MnO_2

e. Mn_3O_4

53. Presence of the following ion of d-elements in solutions can be exploited by means of $\text{K}_4[\text{Fe}(\text{CN})_6]$:

a. Fe^{3+}

b. Cr^{3+}

c. Cu^{2+}

d. Ni^{2+}

e. Zn^{2+}

54. What substance can be used only as a reducing agent in oxidation-reduction reactions?

a. $\text{Na}_2\text{S}_2\text{O}_7$

b. $\text{Na}_2\text{S}_2\text{O}_3$

c. Na_2SO_3

d. Na_2SO_4

e. Na₂S

55. Potassium permanganate KMnO_4 is used in medicine as a bactericidal drug. What chemical properties of KMnO_4 determine its bactericidal action?

a. Acidic

- b. Reducing
- c. Heat-activated dissociability

d. Oxidative

- e. Basic

56. Sodium hydrogen arsenate $\text{Na}_2\text{HAsO}_4 \cdot 7\text{H}_2\text{O}$ is applied in medicine as general health-improving and tonic drug. What type of salts does it relate to?

- a. Double salts
- b. Mixed salts
- c. Neutral salts
- d. Basic salts

e. Acid salts

57. Solution with NaCl mass concentration of 0,95% is a part of a saline and can be used in case of significant blood loss. Name reaction of this solutions medium:

- a. Alkaline ($\text{pH} > 7,0$)
- b. Acidic ($\text{pH} < 7,0$)

c. Neutral ($\text{pH} = 7,0$)

- d. Very acidic ($\text{pH} = 1,0$)
- e. Very alkaline ($\text{pH} = 12,0$)

58. Choose a disulfate acid from the given acids:

a. $\text{H}_2\text{S}_2\text{O}_7$

- b. $\text{H}_2\text{S}_2\text{O}_8$
- c. $\text{H}_2\text{S}_2\text{O}_6$
- d. H_2S
- e. $\text{H}_2\text{S}_2\text{O}_5$

59. Coordination number of iron in the potassium hexacyanoferrate (II) $\text{K}_4[\text{Fe}(\text{CN})_6]$ is:

a. 6

- b. 4
- c. 8
- d. 3
- e. 2

60. As a result of reaction of mercury excess with diluted nitric acid the following gas will escape:

- a. N_2
- b. NH_3

c. NO

- d. N_2O
- e. -

61. Chloride lime is used in medicine as a disinfectant. Its formula is:

- a. $\text{Ca}(\text{ClO}_4)_2$
- b. CaOCl
- c. CaCl_2
- d. $\text{Ca}(\text{ClO}_3)_2$

e. $\text{CaCl}(\text{OCl})$

62. Manganese tetrachloride is very unstable. It can be easily decomposed into:

- a. Cl_2
- b. $\text{Mn} + \text{Cl}_2$

c. $\text{MnCl}_2 + \text{Cl}_2$

- d. Mn
- e. $\text{MnCl}_3 + \text{Cl}_2$

63. The product of potassium permanganate reduction in the neutral medium has the following chemical formula and colour:

- a. K_2MnO_4 , green

- b. MnO_2 , green
- c. MnO_2 , brown**
- d. K_2MnO_4 , violet
- e. MnSO_4 , colourless

64. What is maximal valency of nitrogen in consideration of donor-acceptor mechanism of covalent bond?

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

65. After the diluted solution of hydrochloric acid had been added to the solution under examination, the white caseous precipitate settled down. This indicates presence of the following ions:

- a. Barium
- b. Iodine
- c. Ammonium
- d. Iron (II)
- e. Silver**

66. Many elements have allotropic modifications. Specify the allotropic modification of oxygen:

- a. Corundum
- b. Diamond
- c. Phosgene
- d. Quartz
- e. Ozone**

67. Hydrogen compounds of which element can form hydrogen bonds?

- a. P
- b. I
- c. C
- d. Si
- e. F**

68. Specify the different-ligand complex compound that is used as an antitumour drug:

- a. $[\text{Cu}(\text{NH}_3)_4(\text{SCN})_2]$
- b. $\text{K}_2\text{Na}[\text{Co}(\text{NO}_2)_6]$
- c. $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{Cl}_2$
- d. $\text{Na}_4[\text{Sn}(\text{OH})_3\text{Cl}_3]$
- e. $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$**

69. Which of the following substances does the concentrated sulphuric acid react with along with production of SO_2 ?

- a. NaCl
- b. CuO
- c. Ag**
- d. Ca
- e. $[\text{Mg}(\text{NO}_3)_2]$