

GENERAL AND INORGANIC CHEMISTRY

1. Which of the following substances is an element:

- a) ammonia **b) helium** c) water d) air e) cryolite

2. An element with electron configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ is in the following periode:

- a) the fifth **b) the fourth** c) the first d) the third e) the second

3. An element with electron configuration $1s^2 2s^2 2p^6 3s^2 3p^3$ is in the following periode:

- a) the first b) the fifth c) the fourth d) the sixth **e) the third**

4. In which sequence of elements are there elements with the lowest ionization energy?

- a) C, Si, Ge, Sn, Pb
b) Be, P, Ca, S, Mn
c) N, P, As, Sb, Bi
d) Na, K, Rb, Cs, Fr

5. If an element is in the fourth periode and in the second group, its ordinal number is:

- a) 15 b) 25 **c) 20** d) 18 e) 12

6. If the atomic masses for calcium 40 and for phosphorus 31, then the molecular weight for primary calcium phosphate is:

- a) 256 b) 218 **c) 234** d) 236 e) 416

7. Of these molecules, the largest dipole moment is in:

- a) nitrogen b) hydrogen **c) hydrogen chloride** d) helium e) fluorine

8. An element with atomic number 16 has the properties most similar to an element which atomic number is:

- a) 6 b) 32 **c) 34** d) 17 e) 15

9. The molecular weight of tertiary calcium phosphate is: (Ca = 40, P = 31)

- a) 212 b) 365 c) 135 **d) 310** e) 175

10. The relative atomic mass of iodine is 127. What is the mass of the molecule of that element?

- a) $4,23 \times 10^{19}$ b) 254 c) $2,11 \times 10^{-22}$ **d) $4,23 \times 10^{-22}$** e) $4,23 \times 10^{-19}$

*****The correct answer has written in red colour and bolded*****

11. Which of the following compounds has a covalent bond type?

- a) **PH₃** b) NaH c) CaH₂ d) Na₂O₂

12. Which of the following pairs of chemical elements does not build ionic compounds:

- a) Ca and O b) Ba and J c) Li and Cl d) Na and F e) **C and Cl**

13. Which of the following compounds has an ionic type of bond?

- a) PH₃ b) **Na₂O₂** c) AsH₃ d) NH₃ e) P₂O₅

14. How much litres NO, calculated under standard conditions, results from the complete combustion of 2 moles of ammonia?

- a) 11,2 b) 4,48 c) 2,24 d) 22,4 e) **44,8**

15. Circle the letter in front of the acid oxide formula!

- a) NO b) Al₂O₃ c) **P₂O₅** d) Na₂O e) ZnO

16. Circle the letter in front of the base oxide formula!

- a) **Cs₂O** b) SO₃ c) CO d) SiO₂ e) NO₂

17. Circle the letter in front of the nitric acid anhydride formula!

- a) NO₂ b) **N₂O₃** c) N₂O₅ d) N₂O e) NO

18. Circle the letter in front of the amphoteric oxide formula!

- a) P₂O₃ b) Li₂O c) N₂O₅ d) **ZnO** e) Na₂O

19. Circle the letter in front of the oxide formula which, in reaction with water, gives a double-acid base!

- a) **CaO** b) K₂O c) Cl₂O d) N₂O₅ e) CO₂

20. Circle the letter in front of the oxide formula which, in reaction with sodium hydroxide, can give two types of salts, one acidic and one neutral!

- a) Cl₂O b) **SO₃** c) N₂O₅ d) N₂O₃ e) Cl₂O₇

*****The correct answer has written in red colour and bolded*****

21. Which sequence contains only elements that can build up acidic oxides?

- a) N, P, Cu, Hg, S **b) Cl, P, C, N, B** c) Ca, Sr, Cu, Hg, P
d) Cr, N, P, B, Mn e) S, Mn, Si, Mg, Li

22. Which sequence contains only elements that can build up base oxide?

- a) Si, B, Al, Hg, Na b) B, As, Ca, S, Cl c) F, Fe, Hg, Cu, Ca
d) Cu, Co, Hg, Na, Ca e) F, Na, Mg, Li, Pb

23. Which of these oxides, when reacted with 0.6 moles of calcium hydroxide, provides 0.6 moles of neutral salt?

- a) N_2O b) Fe_2O_3 c) P_2O_5 d) As_2O_5 **e) N_2O_3**

24. Which reaction shows the oxidoreduction reaction?

- a) $2NH_3 + H_2CO_3 = (NH_4)_2CO_3$ b) $Mn_2O_7 + 2KOH = 2KMnO_4 + H_2O$
c) $SO_3 + H_2O = H_2SO_4$ d) $Fe_2O_3 + 3H_2SO_4 = Fe_2(SO_4)_3 + H_2O$
e) $2KClO_3 = 2KCl + 3O_2$

25. Which reaction is possible?:

- a) $2Ag + H_2SO_4 = Ag_2SO_4 + H_2$ b) $Cu + 2HCl = CuCl_2 + H_2$
c) $Zn + 2H_2SO_4 = ZnSO_4 + SO_2 + 2H_2O$
d) $Hg + 2HNO_3 = Hg(NO_3)_2 + H_2$ **e) $Mg + H_2SO_4 = MgSO_4 + H_2$**

26. Which solution obtained by mixing (of equal volume) two solutions of the same concentration (mol / L) reacts acidically?

- a) $CO_2 + NaOH$ b) $H_2S + KOH$ c) $Ca(OH)_2 + HNO_3$
d) $H_3PO_4 + KOH$ e) $KOH + HCN$

27. What is the pH value of the solution containing 3.15 g of nitric acid in 50 mL of solution. N-14?

- a) 1 b) 2 c) 3 d) 4 **e) 0**

28. Circle the letter in front of the concentration for the acidic solution!

- a) $[OH^-] = 10^{-4} \text{ mol/L}$ b) $pH = 7$ c) $[H^+] = 10^{-8} \text{ mol/L}$
d) $pOH = 5$ **e) $6,023 \times 10^{20} \text{ H}^+ \text{ ion/L}$**

*****The correct answer has written in red colour and bolded*****

29. Ampholyteis:

- 1) HCO_3^{2-} 2) NH_4^+ 3) NaCl 4) NaOH 5) CO

30. Find the reaction where oxidation the chlorine atom is occurred.

- 1) $\text{SnCl}_2 + \text{Cl}_2 \rightarrow \text{SnCl}_4$
2) $\text{NaCl} + \text{AgNO}_3 \rightarrow \text{AgCl} + \text{NaNO}_3$
3) $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{Cl}_2 + \text{MnCl}_2 + 2\text{H}_2\text{O}$
4) $\text{HClO} \rightarrow \text{HCl} + \text{O}$
5) $\text{KIO}_3 + 5\text{KI} + 6\text{KCl} \rightarrow 6\text{KCl} + 3\text{I}_2 + 3\text{H}_2\text{O}$

31. Which of the following compounds is written in the form of molecules in ionic reactions?

- 1) HBr 2) LiOH 3) NH_4Cl 4) **AgCl** 5) NaNO_3

32. Conugated acid against base H_2PO_4^- is:

- 1) PO_4^{3-} 2) **H_3PO_4** 3) HPO_4^{2-} 4) H_3O^+ 5) H_2O

33. To which group of the periodic system does the element belong, if it has a configuration $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$

- a) the first b) the sixth c) **the second** d) the seventh e) the third

34. In which compounds the ionic bond is represented.

- a) **KCl, MgCl₂, NaCl, KBr, FeCl₃, LiCl**, b) H_3PO_4 , CO_2 , Cl_2 , HNO_3 , c) H_2SO_4 , N_2 , CO , Cl_2O , NH_3
d) AgJ, HCl, KBr, CaC_2 , e) AlH_3 , NH_3 , H_2S , CuCl

35. Circle the element sequence with the element having the highest electronic affinity!

- a) Be, Mg, Ca, b) Sr, Ba, Li, c) Na, K, Rb, d) Cs, B, Al, e) **F, Cl, S**

36. Bases were added to the acid solutions in the same molar ratio (1: 1). Which of the solutions obtained will react acidicyly?

- a) $\text{HCl} + \text{NaOH}$ b) **$\text{H}_2\text{SO}_4 + \text{NaOH}$** c) $\text{CH}_3\text{COOH} + \text{NaOH}$

37. In the oxido-reduction equation $\text{KMnO}_4 + \text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + \text{KCl} + \text{H}_2\text{O}$ molar ratio of KMnO_4 and HCl is:

- a) 2 : 6 b) 1 : 3 c) 2 : 10 d) 3 : 7 e) **2:16**

38. Calculate the volume under normal conditions of 5 g of nitrogen. Ar (N) = 14 g.

- a) 6.0 b) **4.0** c) 5.6 d) 2.6 e) 7.2

39. Which compound has an ionic type bond:

- a) O_2 b) **CaCl₂** c) NH_3 d) CO

*****The correct answer has written in red colour and bolded*****

40. Which of the following solution mixtures has buffering properties:

- a) HCl+ NaCl **b) $\text{NH}_3 + \text{NH}_4\text{Cl}$** c) NaOH + KCl

41. Circle the colligative property of the solution.

- a) quantitative concentration b) molality **c) osmotic pressure of solution**
d) vapor pressure of pure liquid e) boiling point of solution

42. In the oxide reduction equation $\text{H}_2\text{SO}_3 + \text{J}_2 + \text{H}_2\text{O} \rightarrow \text{H}_2\text{SO}_4 + \text{HJ}$ molar ratio of $\text{H}_2\text{SO}_4 + \text{HJ}$ is:

- a) 1:1 b) 3:2 c) 3:1 d) 2:3 **e) 1:2**

43. Bases were added to the acid solutions in the same molar ratio (1: 1). Which of the solutions obtained will react neutrally?

- a) NaOH + CH_3COOH b) KOH + H_2SO_4 **c) KOH + HCl** d) KOH + HCN e) LiOH + HF

44. In the oxide reduction equation $\text{H}_2\text{O}_2 + \text{KMnO}_4 + \text{H}_2\text{SO}_4 \rightarrow \text{MnSO}_4 + \text{O}_2 + \text{K}_2\text{SO}_4 + \text{H}_2\text{O}$ molar ratio of H_2O_2 i KMnO_4 is:

- a) 1:1 **b) 5:2** c) 3:1 d) 2:3 e) 1:3

45. Calculate the volume under normal conditions of 5 g oxygen: $A_r(\text{O})=16$.

- a) 3.5** b) 2.9 c) 4.5 d) 7.0 e) 1.3

46. Circle the compound where iron has oxidation number two:

- a) FeSO_4** b) ZnCl_2 c) $\text{Fe}(\text{NO}_3)_3$ d) $\text{Fe}(\text{OH})_3$ e) FeCl_3

47. Which of the following compounds is secondary calcium phosphate?

- 1) $\text{Ca}(\text{H}_2\text{PO}_4)_2$ **2) CaHPO_4** 3) $\text{Ca}_3(\text{PO}_4)_2$ 4) CaPHO_3 5) $\text{Ca}(\text{HPO}_3)_2$

48. Circle the letter in front of the acid oxide formula:

- a) CS_2O **b) N_2O_3** c) CO d) $\text{Mg}(\text{OH})_2$ e) ZnO

49. How many milliliters of sodium sulfate solution, concentration 1 mol/L can be obtained from 28.4 g of that salt? ($\text{Na}=23$; $\text{S}=32$).

- a) 240 **b) 200** c) 24 d) 20 e) 220

50. How many milliliters of sodium carbonate solution, at a concentration of 2 mol / L, can get from 31.8 g of that salt? ($\text{Na} = 23$)

- a) 150** b) 190 c) 175 d) 19 e) 15

*****The correct answer has written in red colour and bolded*****

ORGANIC CHEMISTRY

1. What is the name, according to JUPAC nomenclature, for a hydrocarbon having one tertiary atom and a molecular formula C_4H_8 ?

- a) 2-methyl-1-butane b) 2-methyl-1,3-butadiene c) 2-methylpropene
d) 2-methylpropane e) 1-butene

2. How many secondary C-atoms does the 2-methyl-4-ethylhexane molecule contain?

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

3. Which of the following molecular types is an electrophilic reagent?

- a) H_2O b) NH_3 c) OH^- d) CN^- e) **NO_2^+**

4. What is the oxidation number of C-atom in methane?

- a) 0 **b) -4** c) +4 d) +2 e) -2

5. Which of the following gases (under the same conditions) has the highest density?

- a) C_3H_8** b) C_2H_2 c) C_2H_6 d) CO e) C_2H_4

6. Which of the following gases (under the same conditions) has the lowest density?

- a) C_3H_8 **b) C_2H_2** c) C_2H_6 d) CO e) C_2H_4

7. How many monochlorine derivatives can be obtained by chlorination of 2-methyl-propane?

- a) one **b) two** c) three d) four e) none

8. The number of hydrocarbons isomeric to 2,2-dimethylbutane is:

- a) 4** b) 2 c) 6 d) 3 e) 1

9. In which of the following hydrocarbons does the optical isomer occur?:

- a) 2-methylpentane b) 3-methylpentane c) 2,2-dimethylpentane
d) 2,3-dimethylpentane e) 2,4-dimethylpentane

10. Which of the following compounds is isomeric with vinyl-alcohol??

- a) allyl alcohol **b) acetaldehyde** c) divinyl ether
d) acrolein e) vinyl acetic acid

*****The correct answer has written in red colour and bolded*****

11. Which of these compounds does the geometric (*cis-trans*) isomer occur in?

- a) 1-butene **b) 2-butene** c) 1-pentene d) ethene e) propene

12. Which of the following compounds does the *cis-trans* isomer occur in?

- a) 4-methyl-1-pentene **b) 1,3-dimethylcyclopentane** c) isoprene
d) 3-methyl-1-butyne e) 2-pentene

13. In how many isomeric forms does 1,3-dimethylcyclobutane occur?

- a) two** b) three c) four d) five e) none

14. Eten is always more reactive than:

- a) acetylene **b) methane** c) butylene d) propylene e) butadiene

15. Addition of water to 1-butene results in:

- a) 1-butanol **b) 2-butanol** c) 1,2-butanediol d) diethylether e) butanone

16. Addition of sulfuric acid to 2-methyl-1-butene and then hydrolysis of the resulting product results in:

- a) 2-methylbutanol-2** b) 2-methylbutanol c) butanone
d) 2-methylbutanol-1 e) sulfuric acid ester

17. From which of the following compounds can toluene be obtained by dehydrogenation?

- a) o-xylene b) ethyl-benzene c) benzyl-chloride
d) methyl-cyclohexane e) anthracene

18. An aromatic hydrocarbon containing five rings of benzene is:

- a) naphthalene b) benzanthracene **c) benzpyrene**
d) anthracene e) aniline

19. Addition of hydrogen iodide to propene produces:

- a) 1-iod-propane b) 3-iod-propane **c) 2-iod-propane**
d) 2,2-diiod-propane e) propane

20. The reaction of cyclopropane with bromine produces:

- a) 1,2-dibromocyclopropane b) 1,3-dibromocyclopropane **c) 1,3-dibromopropane**
d) 1,2-dibromopropane e) 1,1-dibromocyclopropane

*****The correct answer has written in red colour and bolded*****

21. Oxidation of propylbenzene with a strong oxidizing agent results in:

- a) formic acid b) propionic acid c) salicylic acid **d) benzoic acid** e) 1,4-dioxane

22. If by dehydrogenation of a compound of the molecular formula C_3H_8O a product which reduces the Tollens reagent is obtained, the starting compound is:

- a) primary alcohol** b) ketone c) aldehyde d) secondary alcohol e) ether

23. What alcohol gives 2-methylpropanoic acid by oxidation?

- a) 2-methyl-1-propanol** b) 2-butanol c) 2-methyl-2-propanol
d) 1-butanol e) 2-methyl-propanol

24. 2-methylpropene is produced by dehydration of:

- a) butanone b) 2-butanol c) 1,2-propanediol
d) 2-methyl-2-butanol **e) 2-methyl-2-propanol**

25. Which of the following is an enol?

- a) vinyl-alcohol** b) phenol c) allyl-alcohol
d) 1,2,3-propanetriol e) cresol

26. Which statement is correct?

- a) benzene is more easily oxidized than phenol
b) polyhydroxyl phenols are more difficult to oxidize than phenols
c) pyridine is a weaker base than piperidine
d) alcohols are stronger acids than water

27. Which of the following acids is the strongest in aqueous solution?

- a) CH_3COOH b) $CH_2ClCOOH$ c) $CHCl_2COOH$ **d) CCl_3COOH** e) $ClCH_2CH_2COOH$

28. Hydroxysuccinic acidsalts are:

- a) citrates b) tartarates **c) malates** d) lactates e) urates

29. Ortho-hydroxy-benzoic acid is:

- a) salicylic acid** b) tartaric acid c) oxalic acid d) phthalic acid e) terephthalic acid

*****The correct answer has written in red colour and bolded*****

30. Oxalic acid is obtained by oxidation:

- a) 1,2-propanediol b) propanetriol **c) ethylene glycol** d) glyceraldehyde e) dioxyacetone

31. The relative molecular weight of acrylic acid is:

- a) 74 b) 58 c) 56 d) 73 **e) 72**

32. Dihydroxysuccinic acid is:

- a) lactic acid b) salicylic acid c) phthalic acid d) oxalic acid **e) tartaric acid**

33. Which of the following is not an organic acid derivative?

- a) $C_6H_5CONHCH_3$ b) $C_6H_5COOCOC_6H_5$ c) $CH_3OCOCH_2CH_3$

- d) $C_6H_5CH(NH_2)COOH$** e) $CH_3CH_2CONH_2$

34. Ethyl urethane belongs to:

- a) amide esters** b) diesters c) chloride esters d) diamides e) dichlorides

35. Which of the following is ethyl carbamate?

- a) $H_2NCOOC_2H_5$** b) $H_2NCO-COOC_2H_5$ c) $CH_3CH_2CONH_2$

- d) $H_2NC_6H_4COOC_2H_5$ e) $H_2NCH_2COOC_2H_5$

36. Which of the following is diethyl carbonate?

- a) CH_3OCOCH_3 b) $C_2H_5COC_2H_5$ **c) $C_2H_5OCOOC_2H_5$** d) $C_2H_5CONH_2$ e) $C_2H_5OCONH_2$

37. The formula of formic acid amide is:

- a) CH_3CONH_2 b) $HCOONH_4$ c) CH_3COONH_4 d) $C_6H_5CONH_2$ **e) $HCONH_2$**

38. The catalytic hydrogenation of nitriles produces:

- a) nitro compounds b) carboxylic acids c) amides **d) primary amines** e) nitroso-amines

39. Pyrimidine is:

- a) a five-membered heterocyclic compound with a single nitrogen atom
b) a five-membered heterocyclic compound with two nitrogen atoms
c) a six-membered heterocyclic compound having a single nitrogen atom
d) a six-membered heterocyclic compound having two nitrogen atoms
e) a nine-membered heterocyclic compound with four nitrogen atoms

*****The correct answer has written in red colour and bolded*****

40. Purin is:

- a) a nine-membered heterocyclic compound with four nitrogen atoms
- b) a five-membered heterocyclic compound with two nitrogen atoms
- c) a six-membered heterocyclic compound having a single nitrogen atom
- d) a six-membered heterocyclic compound having two nitrogen atoms
- e) a five membered heterocyclic compound having a single nitrogen atom

41. Cysteine is:

- a) alpha-amino-butyric acid
- b) alpha-amino-beta-methyl-butyric acid
- c) para hydroxy-phenylalanine
- d) alpha-amino-beta-hydroxy-propionic acid
- e) alpha-amino-beta-thiol-propionic acid

42. Lactose consists of:

- a) glucose and galactose
- b) glucose and mannose
- c) galactose and mannose
- d) mannose and fructose
- e) glucose and fructose

43. Carbamic acid provides by heating:

- a) ammonia and carbon dioxide
- b) ammonia and carbon monoxide
- c) urea
- d) ammonium carbonate
- e) cyanamide

44. In reaction with mineral acids, the amines give:

- a) esters
- b) ethers
- c) salts
- d) anhydrides
- e) amides

45. Which of the following compounds has an aromatic property?

- a) cyclopentadiene
- b) pyrrole
- c) glycerol
- d) cyclohexanol
- e) glucose

46. Which compound is included in the composition of a porphyrin ring?

- a) pyridine
- b) quinoline
- c) imidazole
- d) pyrimidine
- e) pyrrole

47. The formula CH_3OCH_3 represents:

- a) dimethyl-ether
- b) dimethyl ester
- c) semiacetal
- d) dimethyl peroxide
- e) aldehyde

The correct answer has written in red colour and bolded

48. Which of the following amino acids contains heterocyclic compounds in the side sequence?

a) phenylalanine b) alanine c) tyrosine **d) histidine** e) glutamine

49. The heterocyclic nucleic acid base is:

- a) aniline
- b) adenine**
- c) an aldehyde
- d) alanine
- e) albumin

50. Purine bases:

- a) enter the protein composition
- b) build polysaccharides
- c) are included in the nucleotide composition**
- d) contain pyridine
- e) are acidic in nature

*****The correct answer has written in red colour and bolded*****