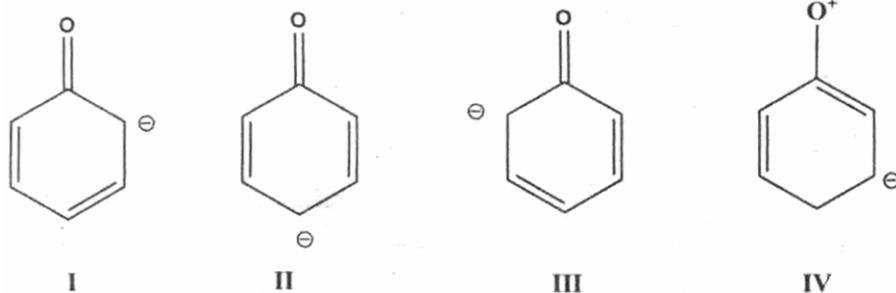


NSEC – 2013-14 SOLUTIONS

1. Which of the following is not a resonating structure for the phenoxide ion?

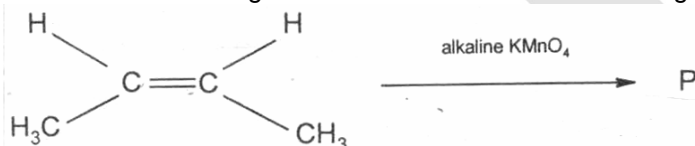


- (A) I (B) II (C) III (D) IV

Ans. (D)

Sol. Oxygen does not carry +ve charge in resonating structures of phenoxide ion.

2. Which of the following statements is true for the reaction given below?

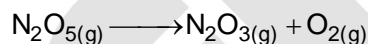


- (A) P is a meso compound 2, 3 – butanediol formed by syn addition.
 (B) P is a meso compound 2, 3 – butanedial formed by anti addition.
 (C) P is racemic mixture of d- and l- 2, 3- butanediol formed by anti addition.
 (D) P is racemic mixture of d- and l- 2,3- butanediol formed by syn addition.

Ans. (A)

Sol. Cis Alkene undergoes syn addition. to form meso product.

3. K_p for the reaction given below is 1.36 at 499K. Which of the following equations can be used to calculate K_c for this reaction?



(A) $K_c = \frac{[(0.0821) \times (499)]}{[1.36]}$

(B) $K_c = \frac{[(1.36) \times (0.0821)]}{[499]}$

(C) $K_c = \frac{[1.36]}{[(0.0821) \times (499)]}$

(D) $K_c = \frac{[(1.36) \times (499)]}{0.0821}$

Ans. (C)

Sol. $K_p = K_c(RT)^{\Delta n}$

4. A 55-kDa protein was acid hydrolysed to obtain a mixture of amino acids. How many amino acids could be present in the solution?

- (A) 550 (B) 500 (C) 1000 (D) 1100

Ans. (B)

Sol. Average molar mass of amino acid is 110 Da.

5. Which of the following phenols is most soluble in aqueous sodium bicarbonate?

- (A) 2, 4-dihydroxyacetophenone (B) p-cyan phenol
 (C) 3, 4-dicyanophenol (D) 2, 4, 6-tricyanophenol

Ans. (D)

Sol. It is most acidic out of all the compounds because of –I & –R effect.

6. 6.24 g of ethanol are vaporized by supplying 5.89 kJ of heat energy. What is the enthalpy of vapourisation of ethanol?

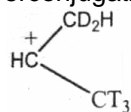
- (A) 43.42 kJ (B) 47.0 KJ (C) 21.75 KJ (D) 435.0 KJ

Ans. (A)

Sol. 43.42 kJ

Enthalpy charge per mole is 43.42 kJ.

7. How many hyperconjugative structures are possible in the following carbocation?



- (A) 1 (B) 3 (C) 5 (D) 6

Ans. (D)

Sol. No. of α -H is 6 so no. of α -T hyperconjugating structures is 6.

8. A DNA sample stored at 4°C was removed from the refrigerator and heated in a hot water bath with temperature increasing gradually. Which bond of the DNA molecule will break first?

- (A) Phosphodiester bond (B) Glycoside linkage (C) Hydrogen bond (D) Covalent bond

Ans. (C)

Sol. Hydrogen bond is weakest.

9. Which of the following salts produces the most basic solution?

- (A) $\text{Al}(\text{CN})_3$ (B) $\text{KC}_2\text{H}_3\text{O}_2$ (C) FeCl_3 (D) KCl

Ans. (B)

Sol. Salt of weak acid strong base.

10. Which of the following compounds has zero dipole moment?

- (A) NH_3 (B) NF_3 (C) BF_3 (D) CHCl_3

Ans. (C)

Sol. BF_3 is planar and symmetrical.

11. An isotone of ${}_{32}\text{Ge}^{76}$ is

- (A) ${}_{32}\text{Ge}^{77}$ (B) ${}_{33}\text{Ge}^{77}$ (C) ${}_{34}\text{Ge}^{77}$ (D) ${}_{35}\text{Ge}^{80}$

Ans. (B)

Sol. Both have same no. of Neutrons.

12. One of the constituents of German silver is

- (A) Ag (B) Mg (C) Cu (D) Al

Ans. (C)

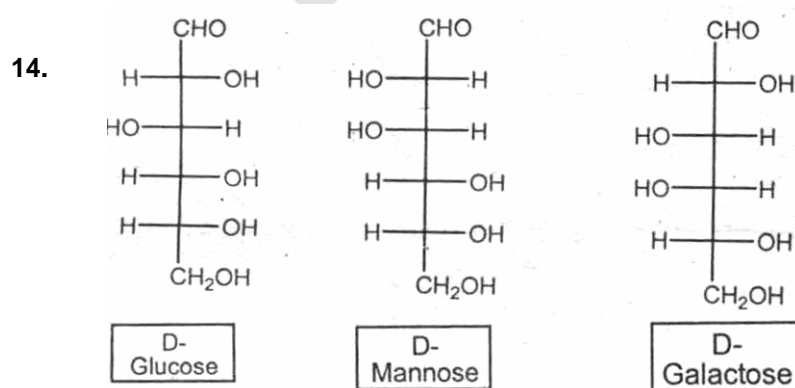
Sol. Composition of German silver is Cu = 60%, Ni = 20%, Zn = 20%.

13. A catalyst is a substance that

- (A) undergoes chemical change to accelerate the rate of the reaction
 (B) decreases the energy of activation of the reaction.
 (C) increases the kinetic energy of the reaction
 (D) lowers the potential energy of the products with respect to that of the reactants.

Ans. (B)

Sol. Catalyst decreases the activation energy.



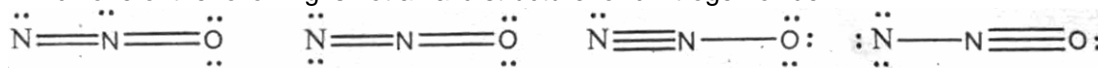
The above structures are related to each other as

- (A) identical substances (B) diastereomers (C) enantiomers (D) epimers

Ans. (B)

Sol. They are optically active isomers but not mirror images of each other.

15. Which one of the following is not a valid structure for dinitrogen oxide?



I

II

III

IV

(A) I

(B) II

(C) III

(D) IV

Ans. (A)

Sol. Nitrogen can not expand its octet.

16. A mixture of acidified $\text{K}_2\text{Cr}_2\text{O}_7$ and 10% KI is titrated against $\text{Na}_2\text{S}_2\text{O}_3$ (Sodium thiosulphate) solution using starch indicator. The colour of the reaction mixture at the end point is :

- (A) Yellow (B) Blue (C) Green (D) Colourless

Ans. (C)

Sol. Cr^{3+} left in solution is green in colour.

17. The gas which liberates bromine from a solution of KBr is :

- (A) Cl_2 (B) I_2 (C) SO_2 (D) HI

Ans. (A)

Sol. Cl_2 displaces Br^- to form Br_2 .

18. The bond order of NO^+ ion is :

- (A) 1 (B) 2 (C) 2.5 (D) 3

Ans. (D)

Sol. Bond order for NO^+ ion is 3.0.

19. What is NOT true for both cellulose and DNA ?

- (A) Both are long chain polymers (B) Both contains similar monomers
(C) Both have glycosidic linkages (D) Both can break down by enzymatic hydrolysis

Ans. (B)

Sol. Monomers for cellulose & DNA are different.

20. An enzyme working at pH 4.5 became inactive when treated with a hydrophobic surfactant. The enzyme may be :

- (A) Cytosolic (B) Extracellular
(C) Peripheral membrane bound (D) Integral membrane bound

Ans. (D)

21. Which of the following is most stable ?

- (A) 2, 3-Dimethyl-2-butene (B) 2-Butene
(C) 2-Methyl-2-butene (D) 1-Butene

Ans. (A)

Sol. It has maximum number of hyperconjugating structures.

22. RNA forms loop structure because :

- (A) It always contain uracyl instead of thymine (B) of presence of nearby complementary bases
(C) all RNA have to form loop structure to function (D) they are always single stranded

Ans. (B)

23. Which is the strongest oxidizing agent among the species given below ?

- (i) In^{3+} $E^0 = -1.34$ V (ii) Au^{3+} $E^0 = 1.40$ V (iii) Hg^{2+} $E^0 = 0.867$ V (iv) Cr^{3+} $E^0 = -0.786$ V
(A) Cr^{3+} (B) Au^{3+} (C) Hg^{2+} (D) In^{3+}

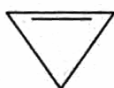
Ans. (B)

Sol. It has highest redox potential.

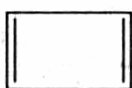
24. Which of the following structures is aromatic ?



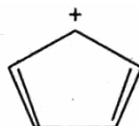
I



II



III



IV

(A) Structures I and II (B) Structures I only

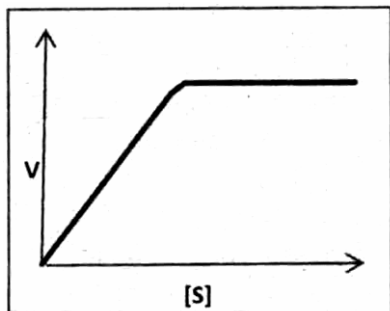
(C) Structure II only

(D) Structure III only

Ans. (A)

Sol. Only pyrrole is aromatic.

25. The kinetics of an enzyme-catalysed hydrolysis reaction is represented by the following graph, where [S] is the substrate concentration and v is the rate of the reaction : The kinetic course of the reaction can be described as :



(A) First order, zero order

(C) First order, second order

(B) Zero order, first order

(D) Second order, first order

Ans. (A)

Sol. Initially order is 1 & then it is 0.

26. The number of unpaired electrons in Ni^{2+} is :

(A) 0

(B) 2

(C) 3

(D) 4

Ans. (B)

Sol. $\text{Ni}^{2+} = [\text{Ar}] 4s^0 3d^8$

27. The colourless ion from among the following is :

(A) Mn^{2+}

(B) Cu^+

(C) Cr^{3+}

(D) Fe^{2+}

Ans. (B)

Sol. Cu^+ is colourless. All others are coloured.

28. The metal carbonyl which is paramagnetic is :

(A) $\text{Ni}(\text{CO})_4$

(B) $\text{V}(\text{CO})_6$

(C) $\text{Cr}(\text{CO})_6$

(D) $\text{Fe}(\text{CO})_5$

Ans. (B)

Sol. It contains unpaired electrons.

29. Which of the following aqueous solution has the lowest electrical conductance ?

(A) 0.01 M CaCl_2

(B) 0.01 M KNO_2

(C) 0.01 M CH_3COOH

(D) 0.01 M CH_3COCH_3

Ans. (D)

Sol. Acetone does not ionise.

30. The reddish-brown gas formed when nitric oxide is oxidized by air is :

(A) NO_2

(B) N_2O_4

(C) N_2O_5

(D) N_2O_3

Ans. (A)

Sol. No is oxidised to NO_2

31. The number of optically active stereoisomers of tartaric acid, $(\text{HOOC}.\text{CHOH}.\text{CHOH}.\text{COOH})$ is :

(A) 4

(B) 2

(C) 1

(D) 3

Ans. (B)

Sol. Tartaric acid has two optically.

32. The electronic level which allows the hydrogen atom to absorb, but not emit a photon is :

(A) 1s

(B) 2s

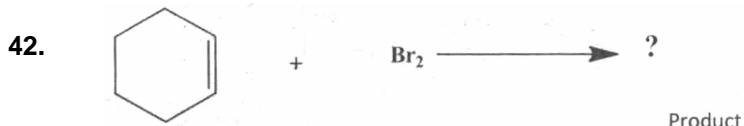
(C) 2p

(D) 3s

Ans. (A)

Sol. Electron can not emit a photon from lowest is level.

33. Salicylic acid on treatment with bromine water will give :
 (A) 2-bromo-6-hydroxybenzoic acid (B) 2, 4, 6-tribromophenol
 (C) 2,6-dibromobenzoic acid (D) 1, 3-dibromo-6-hydroxybenzoic acid
Ans. (B)
Sol. IPSO attack
34. In which of the following compounds is the oxidation number of the transition metal, zero ?
 (A) $[\text{Fe}(\text{H}_2\text{O})_3](\text{OH})_2$ (B) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ (C) $[\text{Ni}(\text{CO})_4]$ (D) $[\text{Pt}(\text{C}_2\text{H}_4)]\text{Cl}_3$
Ans. (C)
Sol. CO is a neutral ligand.
35. If each of the following salts has solubility product $K_{\text{sp}} = 1 \times 10^{-9}$, which of them is least soluble in water ?
 (A) XY (B) X_2Y (C) XY_2 (D) X_3Y
Ans. (A)
Sol. $S = \sqrt{K_{\text{sp}}}$ for A
 $S = \sqrt[3]{\frac{K_{\text{sp}}}{4}}$ for B and C
 $S = \sqrt[4]{\frac{K_{\text{sp}}}{27}}$ for D
36. Bell metal is an alloy of copper and :
 (A) tin (B) aluminium (C) zinc (D) nickel
Ans. (A)
Sol. Bell metal is an Alloy of Cu and Tin.
37. Europium (Eu) and Terbiu (Tb) attain stable $4f^7$ configuration by exhibiting oxidation states of :
 (A) +2 and +4 (B) +3 and +4 (C) +2 and +3 (D) +1 and +3
Ans. (A)
Sol. Eu^{+2} and Tb^{+4} attain stable.
38. Which of the following reaction parameters will change due to addition of a catalyst :
 (A) free energy (B) only equilibrium constant
 (C) only rate constant (D) both Equilibrium constant and rate constant
Ans. (C)
Sol. Only rate constant changes.
39. A plot of $1/[\text{NO}_2]$ verses time for decomposition of NO_2 was found to be linear. This means that the reaction :
 (A) is zero order with respect to $[\text{NO}_2]$
 (B) is first order with respect to $[\text{NO}_2]$
 (C) is second order with respect to $[\text{NO}_2]$
 (D) order cannot be determined from the information given
Ans. (C)
Sol. For a second order reaction $\left[\frac{1}{\text{conc.}} \right]$ vs Time graph is linear.
40. Select the most correct statement among the following :
 (A) $\text{S}_{\text{N}}1$ mechanism takes place in non-polar solvents
 (B) $\text{S}_{\text{N}}2$ mechanism in chiral substrates gives racemic mixtures as products
 (C) $\text{S}_{\text{N}}1$ mechanism is encouraged by polar solvents
 (D) The solvent never influences the mechanism
Ans. (C)
Sol. $\text{S}_{\text{N}}1$ mechanism is favoured by polar solvent.
41. Fehlings solution is :
 (A) AgNO_3 solution + NaOH solution + NH_4OH
 (B) Alkaline solution of Cupric ion complexed with citrate ion
 (C) Copper Sulphate + sodium potassium tartarate + NaOH
 (D) Copper sulphate solution
Ans. (C)



Cyclohexene

The correct name of the product obtained is

- (A) cis -1, 2-dibromocyclohexane (B) cis 1, 4-dibromocyclohexane
(C) trans -1, 2-dibromocyclohexane (D) trans -1, 4-dibromocyclohexane

Ans. (C)

Sol. Anti-addition of Br₂ gives trans product.

43. A solution of sodium metal in liquid ammonia is strongly reducing due to the presence of
(A) sodium atoms (B) sodium hydride (C) sodium amide (D) solvated electrons

Ans. (D)

Sol. Ammoniated electron is responsible for reducing properties.

44. The number of unpaired electrons in Ni²⁺ ion is 2, therefore its spin multiplicity is

- (A) 2 (B) 1 (C) 3 (D) 4

Ans. (C)

Sol. Spin multiplicity = 2s + 1

S = Total spin = 1 for 2 unpaired electrons.

45. A cold aqueous solution of PbCl₂ gives golden yellow precipitate on addition of
(A) KCl solution (B) KI solution (C) NaCl solution (D) K₂SO₄ solution

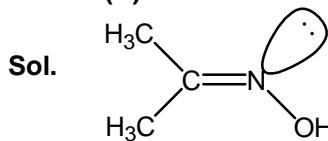
Ans. (B)

Sol. With KI, PbI₂ (Golden yellow) precipitates are formed.

46. Which of the following molecules cannot show geometric isomerism?

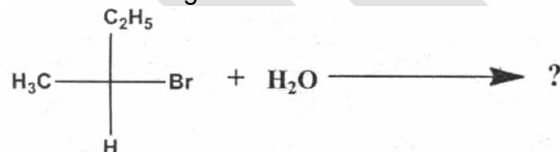
- (A) CH₃CH=NOH (B) (CH₃)₂C=NOH (C) HO-N=N-OH (D) 

Ans. (B)

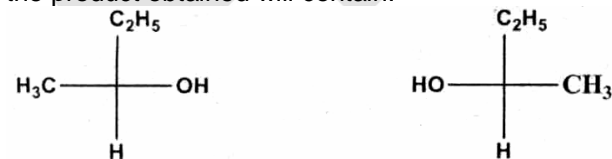


Because of both -CH₃ groups no geometrical isomerism can be shown.

47. In the reaction given below:



the product obtained will contain:



I

II

- (A) Only Compound I (B) Only Compound II
(C) Both Compound I and II (D) This substitution cannot take place

Ans. (C)

Sol. In S_N1 mechanism both the isomers I & II are formed.

48. Acetone and propen-2-ol are
(A) enantiomers (B) keto-enol tautomers (C) diastereoisomers (D) meso compounds

Ans. (B)

Sol. They are keto-enol tautomers.

49. The percentage composition of nitrogen in an organic compound can be determined by
 (A) Dumas method (B) Kjeldahl method (C) Victor's method (D) Hoffman's method
Ans. (A)
Sol. Dumas method is used for determination of percentage nitrogen composition in an organic compound.
50. High spin complexes having coordination number '6' are usually formed through
 (A) sp^3d^2 hybridisation (B) d^2sp^3 hybridisation (C) sp^3 hybridisation (D) sp^3d hybridisation
Ans. (A)
Sol. Outer orbital complexes are high spin complexes.
51. The blood red color obtained in the detection of nitrogen and sulphur together in an organic compound in Lassaigne's test is due to
 (A) $[Fe(CNS)]^+$ (B) $[Fe(CNS)_2]^+$ (C) $[Fe(CNS)_3]^-$ (D) $[Fe(CNS)_2]^{2+}$
Ans. (B)
52. A protein attached to a carbohydrate moiety is called as :
 (A) Lipoprotein (B) Nucleoprotein (C) Apoprotein (D) Glycoprotein
Ans. (D)
Sol. These are called Glycoprotein.
53. How old is a fossil bone whose ^{14}C content is 15.0% of that living bone ? Half life of ^{14}C isotope is 5.73×10^3 yr.
 (A) 25488 yr (B) 15688 yr (C) 388 yr (D) 6818 yr
Ans. (B)
Sol. $t = \frac{2.303}{K} \log \frac{N_0}{N}$ and $K = \frac{0.693}{t_{1/2}}$
54. How much chemical energy is fixed in the form of ATP upon complete oxidation of one mole of glucose ? (Hydrolysis of ATP yields 7.5 kcal/mole) :
 (A) 360 (B) 300 (C) 270 (D) 200
Ans. (C)
Sol. Net 36 ATP molecules are produced.
55. The value of the constant in Nernst equation
 $E = E^0 - \frac{\text{constant}}{n} \ln Q$ at 25°C is
 (A) 0.592 (B) 0.0592 (C) 0.296 (D) 0.096
Ans. (B)
Sol. $\frac{2.303RT}{F} = 0.0592$
56. The chemical formula of Plaster of Paris is :
 (A) $2CaSO_4 \cdot H_2O$ (B) $CaSO_4 \cdot 2H_2O$ (C) $3CaSO_4 \cdot 2H_2O$ (D) $CaSO_4 \cdot H_2O$
Ans. (A)
Sol. Plaster of Paris is $CaSO_4$ hemihydrate.
57. The K_p/K_c ratio for the reaction :
 $4NH_3(g) + 7O_2(g) \rightleftharpoons 4NO(g) + 6H_2O(g)$, at 127°C is
 (A) 0.0301 (B) 0.831 (C) 1.0001 (D) 33.26
Ans. (A)
Sol. $K_p = K_c(RT)^{\Delta n}$
 $\Delta n = -1$
58. Van Arkel method of purification of metals involves converting the metal to a :
 (A) Volatile compound (B) Volatile unstable compound
 (C) Non-volatile stable compound (D) Non-volatile unstable compound
Ans. (A)
Sol. A volatile compound is formed.

59. Which of the following reaction mechanisms does not involve carbocation as an intermediate ?
 (A) Baeyer-Villiger Oxidation (B) Beckman rearrangement
 (C) Fries Rearrangement (D) Diels-Alder Reaction

Ans. (D)

Sol. Diels-Alder reaction does not involve a carbocation.

60. Which of the following statements is correct ?
 (A) NO_2 group activates the benzene ring for attack of electrophile at ortho and para positions
 (B) NH_2 group activates the benzene ring for attack of electrophile at ortho and para positions
 (C) Both $-\text{NO}_2$ group as well as $-\text{NH}_2$ group activate the benzene ring for attack of electrophile at ortho and para positions.
 (D) Neither $-\text{NO}_2$ group nor $-\text{NH}_2$ group activate the benzene ring for attack of electrophile at ortho and para positions.

Ans. (B)

Sol. $-\text{NH}_2$ group is an activator.

61. Which of the following does not have an active methylene group :
 (A) $\text{CH}_3\text{CH}_2\text{NO}_2$ (B) $\text{CH}_3\text{COCH}_2\text{COCH}_3$ (C) $\text{Ph COCH}_2\text{CN}$ (D) $\text{CH}_3\text{CH}_2\text{NH}_2$

Ans. (D)

Sol. $-\text{NH}_2$ group is having +R effect.

62. $\text{CH}_2=\text{CHCl}$ is monomer of :
 (A) Poly styrene (B) Natural rubber (C) PVC (D) Nylon-6

Ans. (C)

Sol. Vinyl chloride forms PVC.

63. A cell membrane acts as a semi-permeable selective boundary because it contains :
 (A) Lipids and carbohydrates (B) Protein and carbohydrates
 (C) Proteins and Nucleic acids (D) Lipids and proteins

Ans. (D)

Sol. 4s has lesser $(n+l)$ value



64. 4-s orbital has lesser energy than 3d orbital because has :
 (A) greater value of n (B) lesser value of l (C) lesser value of $(n+l)$ (D) $l=0$

Ans. (C)

65. When zinc rod is directly placed in copper sulphate solution :
 (A) the blue colour of the solution starts intensifying (B) the solution remains electrically neutral
 (C) the temperature of the solution falls (D) the weight of zinc rod starts increasing

Ans. (B)

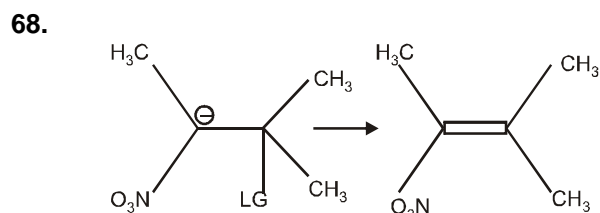
66. The linear molecule among the following is :
 (A) CO_2 (B) NO_2 (C) SO_2 (D) ClO_2

Ans. (A)

Sol. CO_2 has sp hybridisation.

67. In the compound $\text{Na}_2\text{S}_2\text{O}_3$, the oxidation state of sulphur is :
 (A) -2 (B) +2 (C) +4 (D) +6

Ans. (B)



The carbanion expels a leaving group LG to yield an alkene as shown above by

- (A) $\text{E}_{1\text{cB}}$ mechanism (B) E_1 mechanism
 (C) E_2 mechanism (D) Such a reaction does not take place

Ans. (A)

Sol. It is E_1 CB mechanism.

69. The pH of 0.1M NH_4OH , ($K_b = 1.8 \times 10^{-5}$, $K_w = 10^{-14}$), is:

(A) 1.0 (B) 5.7 (C) 11.1 (D) 13.0

Ans. (C)

Sol. $pOH = \frac{1}{2}(pk_b - C)$

70. In animals, the stored carbohydrates is :

(A) Starch (B) Glycogen (C) Sucrose (D) Fructan

Ans. (B)

Sol. Carbohydrates are stored as glycogen.

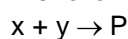
71. The shows positive Joule-Thomson effect below its :

(A) Boyle Temperature (B) Critical Temperature
(C) Inversion Temperature (D) Transition Temperature

Ans. (C)

Sol. Below inversion temperature a gas shows +ve Joule-Thomson effect.

72. The following data was recorded for the reaction



Set No.	[A]	[B]	Rate of the reaction
I	0.1 M	0.2 M	0.001
II	0.2 M	0.2 M	0.004
III	0.2 M	0.8 M	0.008

The order of the reaction is

(A) 1 (B) 2 (C) 2.5 (D) 3

Ans. (C)

Sol. Order w.r.t. A = 2

Order w.r.t. B = 0.5

73. Which solution has the highest pH :

(A) 0.01M $CaCl_2$ (B) 0.01 M KNO_2 (C) 0.01M CH_3COOH (D) 0.01M CH_3COCH_3

Ans. (B)

Sol. It is a salt of weak acid and strong base.

74. The minimum number of H^+ ions that can be released by an amino acid is :

(A) 1 (B) 2 (C) 3 (D) 4

Ans. (A)

75. Which of the following molecular structures is NOT possible :

(A) OF_2 (B) SF_2 (C) OF_4 (D) SF_4

Ans. (C)

76. The ions which give black precipitates on passing H_2S gas in acidic medium are :

(A) Al^{3+} and Ni^{2+} (B) Ni^{2+} and CO^{2+} (C) Cu^{2+} and Bi^{3+} (D) Zn^{2+} and Mn^{2+}

Ans. (C)

Sol. Cu^{2+} & Bi^{3+} give black sulphides.

77. For a chemical reaction ΔH is negative and ΔS is positive. This reaction is :

(A) spontaneous at all temperatures (B) nonspontaneous at all temperatures
(C) spontaneous only at high temperatures (D) spontaneous only at low temperatures

Ans. (A)

Sol. $\Delta G = \Delta H - T\Delta S$

78. Which of the following salt/s of H_3PO_3 exists ?
(I) NaH_2PO_3 (II) Na_2NHPO_3 (III) Na_3PO_3
(A) I and II only (B) I and III (C) II and III only (D) III only

Ans. (A)

Sol. H_3PO_3 can lose a maximum of two H^+

79. Which of the following molecules is most volatile ?
(A) Salicylaldehyde (B) p - nitrophenol
(C) p-hydroxybenzoic acid (D) m-hydroxybenzoic acid

Ans. (A)

Sol. It has intramolecular hydrogen bonding.

80. The isoelectric point of an amino acid is :
(A) The pH at which it exists in the acidic form (B) The pH at which exists in the basic form
(C) the pH at which it exists in the Zwitterion form (D) The pH which is equal to its pK_a value

Ans. (C)

Sol. At isoelectric point amino acid does not move towards any electrode & exists as Zwitter ion.

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