Q. 1. Which one of the following is the correct statement?

i. Chlorides of both beryllium and aluminium have bridged chloride structures in solid phase.
ii. $B_2H_6.2NH_3$ is known as 'inorganic benzene'.
iii. Boric acid is a protonic acid.
iv. Beryllium exhibits coordination number of six.

Ans:- 2

Q. 2. The treatment of CH_3MgX with $CH3C \equiv C - H$ produce

i. $CH_3 - \overset{\overset{H}{|}}{C} = \overset{\overset{H}{|}}{C} - CH_3$
ii. CH_4
iii. $CH_3 - CH = CH_2$
iv. $CH_3C \equiv C - CH_3$

Sol: 2

Q. 3. The correct decreasing order of priority for the functional groups of organic compounds in the IUPAC system of nomenclature is

i. $-CHO, -COOH, -SO_3H, -CONH_2$
ii. $CONH_2 -CHO, -SO_3H - COOH,$
iii. $-COOH, -SO_3H, -CONH_2 -CHO,$
iv. $-SO_3H, -COOH, , -CONH_2 -CHO,$

Sol:- 3

Q. 4. The pK_a of a weak acid, HA is 4.80. The pK_b of a weak base, BOH, is 4.78. The pH of an aqueous solution of the corresponding salt, BA, will be

i. 7.01

ii. 9.22
iii. 9.58
iv. 4.79

Sol: 1

Q. 5.The hydrocarbon which can react with sodium in liquid ammonia is

i. $CH_3CH=CHCH_3$
ii. $CH_3CH_2C\equiv CCH_2CH_3$
iii. $CH_3CH_2C\equiv CCH_2CH_2CH_3$
iv. $CH_3CH_2C\equiv CH$

Sol: 4

Q. 6.

Given $E^0_{Cr^{3+}/Cr} = -0.72V$, $E^0_{Fe^{2+}/Fe} = -0.42V$. The potential for the cell
$Cr|Cr^{3+}\ (0.1M)\,||\,Fe^{2+}\ (0.01\ M)|Fe$ is

i. -0.339 V
ii. -0.26 V
iii. 0.26 V
iv. 0.339 V

Sol: 3

Q. 7. Amount of oxalic acid present in a solution can be determined by its titration with $KMnO_4$solution in the presence of H_2SO_4. The titration gives unsatisfactory result when carried out in the presence of HCl, because HCl

i. reduces permanganate to Mn^{2+}.
ii. oxidises oxalic acid to carbon dioxide and water.
iii. gets oxidised by oxalic acid to chlorine.
iv. furnishes H^+ ions in addition to those from oxalic acid.

Sol: 1.

Q. 8. Among the following substituted silanes the one which will give rise to cross linked silicone polymer on hydrolysis is

i. R_2SiCl_2
ii. R_3SiCl
iii. R_4Si
iv. $RSiCl_3$

Sol: 4

Q. 9. Oxidising power of chlorine in aqueous solution can be determined by the parameters indicated below:

$$\frac{1}{2}Cl_2(g) \xrightarrow{\frac{1}{2}\Delta_{diss}H^\ominus} Cl(g) \xrightarrow{\Delta_{ag}H^\ominus} Cl^-(g) \xrightarrow{\Delta_{hyd}H^\ominus} Cl^-(aq)$$

The energy involved in the conversion of

$\frac{1}{2}$ $Cl_2(g)$ to $Cl^-(aq)$

(using the data, $\Delta_{diss}H^\ominus_{Cl_2}$ = 240 Kj mol^{-1}, $\Delta_{eg}H^\ominus_{Cl}$ = -349 kj mol^{-1}, $\Delta_{hyd}H_{Cl^-}$ = -381 KJ mol^{-1}) will be

i. –850 kJ mol^{-1}
ii. +120 kJ mol^{-1}
iii. +152 kJ mol^{-1}
iv. –610 kJ mol^{-1}

Sol: 4

Q. 10. Which of the following factors is of no significance for roasting sulphide ores to the oxides and not subjecting the sulphide ores to carbon reduction directly?

i. Metal sulphides are less stable than the corresponding oxides.
ii. $CO_2$is more volatile than CS_2.
iii. Metal sulphides are thermodynamically more stable than CS_2.
iv. $CO_2$is thermodynamically more stable than CS_2.

Sol: 1

Q. 11. Four species are listed below:

i. HCO_3^-
ii. H_3O^+
iii. HCO_4^-
iv. HSO_3F

Which one of the following is the correct sequence of their acid strength?

(1) (i) < (iii) < (ii) < (iv) (2) (iii) < (i) < (iv) < (ii) (3) (iv) < (ii) < (iii) < (i) (4) (ii) < (iii) < (i) < (iv)

Sol: 1

Q. 12. Which one of the following constitutes a group of the isoelectronic species?

i. $CN^-, N^2, O_2^{-2}, C_2^{-2}$
ii. N^2, O_2^-, NO^+, CO
iii. $C_2^{-2}. O_2^{-2}. CO. NO$
iv. $NO^+, C_2^{-2}, CN^-. N_2$

Sol: 4

Q. 13. Phenol, when it first reacts with concentrated sulphuric acid and then with concentrated nitric acid, gives

i. p-nitrophenol
ii. nitrobenzene
iii. 2,4,6-trinitrobenzene
iv. o-nitrophenol

Sol: 4

Q. 14. The ionization enthalpy of hydrogen atom is 1.312×10^6 J mol^{-1}. The energy required to excite the electron in the atom from n = 1 to n = 2 is

i. $7.56 \times 10^5\ J\ mol^{-1}$

ii. $9.84 \times 10^{5}\ J\ mol^{-1}$
iii. $8.51 \times 10^{5}\ J\ mol^{-1}$
iv. $6.56 \times 10^{5}\ J\ mol^{-1}$

Sol: 2

Q. 15. The organic chloro compound, which shows complete stereochemical inversion during a S_N2 reaction, is

i. $(CH_3)_2CHCl$
ii. CH_3Cl
iii. $(C_2H_5)_2CHCl$
iv. $(CH_3)_3CCl$

Sol: 2

Q. 16. Toluene is nitrated and the resulting product is reduced with tin and hydrochloric acid. The product so obtained is diazotized and then heated with cuprous bromide. The reaction mixture so formed contains

i. mixture of o-; and p-bromoanilines
ii. mixture of o- and m-bromotoluenes
iii. mixture of o- and p-bromotoluenes
iv. mixture of o- and p-dibromobenzenes

Sol: 3

Q. 17. In the following sequence of reactions, the alkene affords the compound 'B'

$$CH_3CH=CHCH_3 \xrightarrow{O_3} A \xrightarrow[Zn]{H_2O} B$$

The compound B is

i. $CH_3CH_2COCH_3$
ii. CH_3CHO
iii. CH_3CH_2CHO
iv. CH_3COCH_3

Sol: 2

Q. 18. Which one of the following pairs of species have the same bond order?

i. O_2^- and CN^-
ii. NO^+ and CN^+
iii. CN^- and NO^+
iv. CN^- and CN^+

Sol: 3

Q. 19. At 80^{0}C, the vapour pressure of pure liquid 'A' is 520 mm Hg and that of pure liquid 'B' is 1000 mm Hg. If a mixture solution of 'A' and 'B' boils at 80^{0}C and 1 atm pressure, the amount of 'A' in the mixture is (1 atm = 760 mm Hg)

i. 48 mol percent
ii. 50 mol percent
iii. 52 mol percent
iv. 34 mol percent

Sol: 2

Q. 20. For a reaction $\frac{1}{2}A \rightarrow 2B$, rate of disappearance of 'A' is related to the rate of appearance of 'B' by the expression

i. $-\frac{d[A]}{dt} = \frac{d[B]}{dt}$
ii. $-\frac{d[A]}{dt} = 4\frac{d[B]}{dt}$
iii. $-\frac{d[A]}{dt} = \frac{1}{2}\frac{d[B]}{dt}$
iv. $-\frac{d[A]}{dt} = \frac{1}{4}\frac{d[B]}{dt}$

Sol: 4

Q. 21. The equilibrium constants K_{p1} and K_{p2} for the reactions $X \leftrightarrow 2Y$ and $Z \leftrightarrow P + Q$ respectively are in the ratio of 1 : 9. If the degree of dissociation of X and Z be equal then the ratio of total pressures at these equilibria is

i. 1 : 3
ii. 1 : 9
iii. 1 : 36
iv. 1 : 1

Sol: 3

Q. 22. In context with the industrial preparation of hydrogen from water gas ($CO + H_2$), which of the following is the correct statement?

i. H_2 is removed through occlusion with Pd.
ii. CO is oxidised to CO_2 with steam in the presence of a catalyst followed by absorption of CO_2in alkali.
iii. CO and $H_2$are fractionally separated using differences in their densities.
iv. CO is removed by absorption in aqueous Cu_2Cl_2solution.

Sol: 2

Q. 23. In which of the following octahedral complexes of Co (atomic number 27), will the magnitude of Δ_o be the highest?

i. $[Co(H_2O)_6]^{3+}$
ii. $[Co(NH_3)_6]^{3+}$
iii. $[Co(CN)_6]^{3-}$
iv. $[Co(C_2O_4)_3]^{3-}$

Sol: 3

Q. 24. The coordination number and the oxidation state of the element 'E' in the complex $[E(en)_2(C_2O_4)]NO_2$ (where (en) is ethylene diamine) are, respectively,

i. 4 and 3
ii. 6 and 3
iii. 6 and 2
iv. 4 and 2

Sol: 2

Q. 25. Identify the wrong statement in the following:

i. Ozone layer does not permit infrared radiation from the sun to reach the earth.
ii. Acid rain is mostly because of oxides of nitrogen and sulphur.
iii. Chlorofluorocarbons are responsible for ozone layer depletion.
iv. Greenhouse effect is responsible for global warming.

Sol: c1

Q. 26. Larger number of oxidation states are exhibited by the actinoids than those by lanthanoids, the main reason being

i. more energy difference between 5f and 6d than between 4f and 5d orbitals.
ii. more reactive nature of the actinoids than the lanthanoids.
iii. 4f orbitals more diffused than the 5f orbitals.
iv. lesser energy difference between 5f and 6d than between 4f and 5d orbitals.

Sol: 4

Q. 27. In a compound, atoms of element Y form ccp lattice and those of element X occupy $2/3^{rd}$ of tetrahedral voids. The formula of the compound will be

i. X_2Y
ii. X_3Y_4
iii. X_4Y_3
iv. X_2Y_3

Sol: 3

Q. 28. Gold numbers of protective colloids (A), (B), (C) and (D) are 0.50, 0.01, 0.10 and 0.005, respectively. The correct order of their protective powers is

i. (A) < (C) < (B) < (D)
ii. (B) < (D) < (A) < (C)
iii. (D) < (A) < (C) < (B)
iv. (C) < (B) < (D) < (A)

Sol:1

Q. 29. The vapour pressure of water at 20^0C is 17.5 mm Hg. If 18 g of glucose ($C_6H1_2O_6$) is added to 178.2 g of water at 20^0C, the vapour pressure of the resulting solution will be

i. 16.500 mm Hg
ii. 17.325 mm Hg
iii. 17.675 mm Hg
iv. 15.750 mm Hg

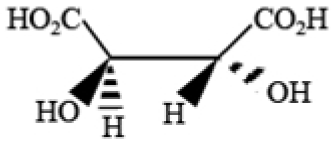
Sol: 2

Q. 30. Bakelite is obtained from phenol by reacting with

i. CH_3COCH_3
ii. HCHO
iii. $(CH_2OH)_2$
iv. CH_3CHO

Sol: 2

Q. 31. The absolute configuration of is



i. R, S
ii. S, R
iii. S, S
iv. R, R

Sol: 4

Q. 32. For the following three reactions a, b, c, equilibrium constants are given:

a. $CO(g) + H_2O(g) \leftrightarrow CO_2(g) + H_2(g);\ K_1$

b. $CH_4(g) + H_2O(g) \leftrightarrow CO(g) + 3H_2(g);\ K_2$

c. $CH_4(g) + 2H_2O(g) \leftrightarrow CO_2(g) + 4H_2(g);\ K_3$

Which of the following relations is correct?

i. $K_3 = K_1 K_2$
ii. $K_3\ K_2^3 = K_1^2$
iii. $K_1 \sqrt{K_2} = K_3$
iv. $K_2\ K_3 = K_1$

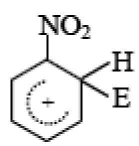
Sol: 1

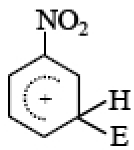
Q. 33. Standard entropy of X2, Y2 and XY3 are 60, 40 and 50 JK^{-1}mol^{-1}, respectively. For the reaction, $\frac{1}{2}X_2 + \frac{3}{2}Y_2 \rightarrow XY_3, \Delta H = -30\ KJ,$, to be at equilibrium, the temperature will be

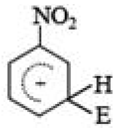
i. 750 K
ii. 1000 K
iii. 1250 K
iv. 500 K

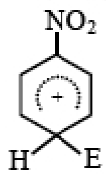
Sol: 1

Q. 34. The electrophile, $E^{\oplus}$ attacks the benzene ring to generate the intermediate $\sigma -$ complex. Of the following, which $\sigma -$ complex is of lowest energy?

i. 

ii. 

iii. 

iv. 

Sol: 4

Q. 35. α–D–(+)–glucose and β–D–(+)– Glucose are

i. anomers
ii. enantiomers
iii. conformers
iv. epimers

Sol: 1