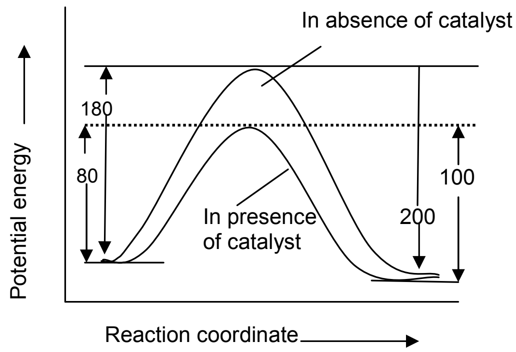
81. The energies of activation for forward and reverse reactions for $A_2 + B_2 \rightleftharpoons 2AB$ are 180 kJ mol^{-1} and 200 kJ mol^{-1} respectively. The presence of catalyst lowers the activation energy of both (forward and reverse) reactions by 100 kJ mol^{-1}. The enthalpy change of the reaction $\left(A_2 + B_2 \longrightarrow 2AB\right)$ in the presence of catalyst will be (in kJ mol^{-1})

(1) 300 (2) 120
(3) 280 (4) 20

Ans. (4)

Sol.



So, $\Delta H_{Reaction} = E_f - E_b$
= 80 – 100 = -20
Hence, (4) is correct.

82. The cell, $Zn \mid Zn^{2+}(1M) \parallel Cu^{2+}(1M) \mid Cu\left(E^0_{cell} = 1.10V\right)$, was allowed to be completely discharged at 298 K. The relative concentration of Zn^{2+} to Cu^{2+} $\left[\frac{[Zn^{2+}]}{[Cu^{2+}]}\right]$ is

(1) antilog (24.08) (2) 37.3
(3) $10^{37.3}$ (4) 9.65×10^4

Ans. (3)

Sol. $E_{cell} = E^o_{cell} - \frac{0.0591}{n}\log Q$

Where Q = $\frac{[Zn^{2+}]}{[Cu^{2+}]}$

For complete discharge E_{cell} = 0

So $E^o_{cell} = \frac{0.591}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$

$\Rightarrow \left|\frac{[Zn^{2+}]}{[Cu^{2+}]}\right| = 10^{37.3}$

Hence, (3) is correct.

83. The pKa of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which 50% of the acid is ionized is

(1) 4.5 (2) 2.5
(3) 9.5 (4) 7.0

Ans. (3)

Sol. For buffer solution

pH = pK_a + log $\frac{[Salt]}{[Acid]}$

= 4.5 + log $\frac{[Salt]}{[Acid]}$

as HA is 50% ionized so [Salt] = [Acid]

pH = 4.5
pH + pOH = 14
$\Rightarrow$ pOH = 14 – 4.5 = 9.5
Hence (3) is correct.

84. Consider the reaction,
$2A + B \rightarrow$ Products
When concentration of B alone was doubled, the half-life did not change. When the concentration of A alone was doubled, the rate increased by two times. The unit of rate constant for this reaction is
(1) L mol^{-1} s^{-1} (2) no unit
(3) mol L^{-1} s^{-1} (4) s^{-1}

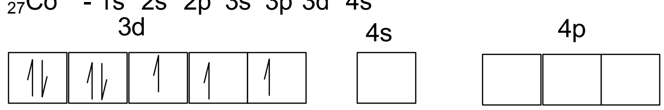
Ans. (1)
Sol. $2A + B \rightarrow$ Product
When conc. of B is doubled, the half life did not change, hence reaction is of first order w.r.t. B.
When concentration of A is doubled, reaction rate is doubled, hence reaction is of first order w.r.t. A.
Hence over all order of reaction is 1 + 1 = 2
So, unit of rate constant mol^{-1} lit s^{-1}.
Hence, (1) is correct.

85. Identify the incorrect statement among the following
(1) d-Block elements show irregular and erratic chemical properties among themselves
(2) La and Lu have partially filled d orbitals and no other partially filled orbitals
(3) The chemistry of various lanthanoids is very similar
(4) 4f and 5f orbitals are equally shielded

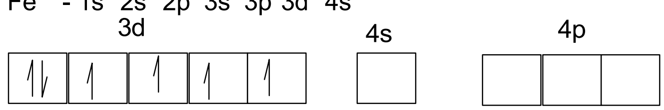
Ans. (4)
Sol. 4f and 5f belongs to different energy levels, hence the shielding effect is on them is not the same.
Shielding of 4f is more than 5f.
Hence (4) is correct.

86. Which one of the following has a square planar geometry?
(1) $[CoCl_4]^{2-}$ (2) $[FeCl_4]^{2-}$
(3) $[NiCl_4]^{2-}$ (4) $[PtCl_4]^{2-}$

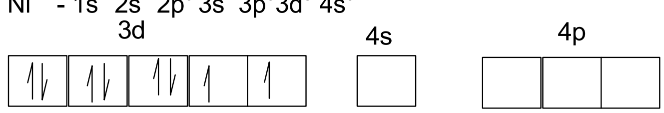
Ans. (4)
Sol. $_{27}Co^{2+}$ - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^7\ 4s^0$



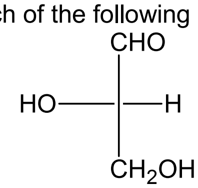
As Cl^- is weak field ligand so no pairing up.
Hence it is sp^3 hybridized giving tetrahedral geometry.
Fe^{2+} - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^6\ 4s^0$

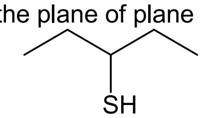


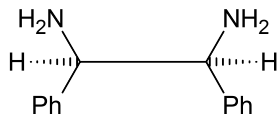
Due to Cl^-, back pairing is not observed so it will be sp^3 hybridized giving tetrahedral geometry.
Ni^{2+} - $1s^2\ 2s^2\ 2p^6\ 3s^2\ 3p^6 3d^8\ 4s^0$

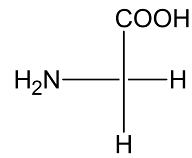


Because weak ligand, back pairing is not observed so it will be sp^3 i.e. tetrahedral geometry.
All the complexes of Pt^{2+} are square planar including those with weak field ligand such as halide ions thus (4) is correct.

87. Which of the following molecules is expected to rotate the plane of plane polarized light?
(1)


(2)


(3) 

(4) 

Ans. (1)

Sol. The plane of polarized light is rotated by optically active compound, i.e. it should be chiral.
So, (1) has, chiral C-atom. So, it is optically active.
In (2), (3) and (4) plane of symmetry is present.
Hence, (1) is correct.

88. The secondary structure of a protein refers to

(1) α-helical backbone
(2) hydrophobic interactions
(3) sequence of α-amino acids
(4) fixed configuration of the polypeptide backbone

Ans. (1)

Sol. Secondary structure of proteins involves $\alpha-$helical back bond and $\beta-$sheet structures. These structures are formed as a result of H-bonding between different peptide groups.
Hence, (1) is correct

89. Which of the following reactions will yield 2, 2-dibromopropane?

(1) $CH_3-C\equiv CH+2HBr\longrightarrow$
(2) $CH_3CH\equiv CHBr+HBr\longrightarrow$
(3) $CH\equiv CH+2HBr\longrightarrow$
(4) $CH_3-CH=CH_2+HBr\longrightarrow$

Ans. (1)

Sol. $CH_3-C\equiv CH+HBr\xrightarrow[\text{(from HBr)}]{\text{electrophilic addition of }H^+}CH_3-\underset{\underset{Br}{|}}{C}=CH_2\xrightarrow{HBr}CH_3-\overset{\overset{Br}{|}}{\underset{\underset{Br}{|}}{C}}-CH_3$

Hence, (1) is correct.

90. In the chemical reaction,
$CH_3CH_2NH_2-CHCl_3+3KOH\longrightarrow(A)+(B)+3H_2O$, the compound (A) and (B) are respectively

(1) C_2H_5CN and 3KCl
(2) $CH_3CH_2CONH_2$ and 3KCl
(3) C_2H_5NC and K_2CO_3
(4) C_2H_5NC and 3KCl

Ans. (4)

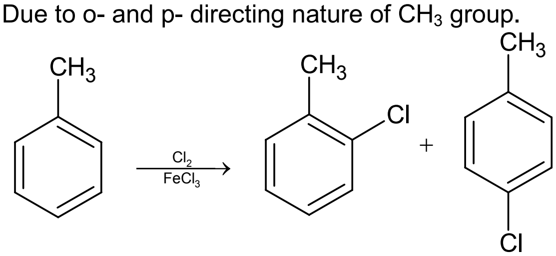
Sol. It is example of carbylamine reaction. so, the product will be C_2H_5NC and KCl.
Hence, (4) is the correct answer.

91. The reaction of toluene with Cl_2 in presence of $FeCl_3$ gives predominantly

(1) benzoyl chloride
(2) benzyl chloride
(3) o-and p-chlorotoluene
(4) m-chlorotoluene

Ans. (3)

Sol. Due to o- and p- directing nature of CH_3 group.



Hence, (3) is correct answer.

92. Presence of a nitro group in a benzene ring

(1) activates the ring towards electrophilic substitution
(2) renders the ring basic
(3) deactivates the ring towards nucleophilic substitution
(4) deactivates the ring towards electrophilic substitution

Ans. (4)

Sol. - NO_2 group shows – M effect, so withdraws the electron density from the ring and hence deactivate the ring towards electrophilic aromatic substitution.
Hence, (4) is correct.

93. In which of the following ionization processes, the bond order has increased and the magnetic behaviour has changed?

(1) $C_2 \longrightarrow C_2^+$ (2) $NO \longrightarrow NO^+$

(3) $O_2 \longrightarrow O_2^+$ (4) $N_2 \longrightarrow N_2^+$

Ans. (2)

Sol. In $C_2 - C_2^+$ electron is removed from bonding molecular orbital so bond order decreases. In NO $\longrightarrow$ NO^+, electron is removed from anti bonding molecular orbital so bond order increases and nature changes from paramagnetic to diamagnetic.
Hence, (2) is correct.

94. The actinoids exhibits more number of oxidation states in general than the lanthanoids. This is because

(1) the 5f orbitals are more buried than the 4f orbitals
(2) there is a similarity between 4f and 5f orbitals in their angular part of the wave function
(3) the actinoids are more reactive than the lanthanoids
(4) the 5f orbitals extend further from the nucleus than the 4f orbitals

Ans. (4)

Sol. The actinoids exhibit more number of oxidation states in general than the lanthanoids. This is because the 5f orbitals extend further from the nucleus than the 4f orbitals.
Hence, (4) is correct.

95. Equal masses of methane and oxygen are mixed in an empty container at 25°C. The fraction of the total pressure exerted by oxygen is

(1) $\frac{2}{3}$ (2) $\frac{1}{3}\times\frac{273}{298}$

(3) $\frac{1}{3}$ (4) $\frac{1}{2}$

Ans. (3)

Sol. Let the mass of methane and oxygen is w

$$\text{mole fraction of oxygen} = \frac{\frac{w}{32}}{\frac{w}{32}+\frac{w}{16}}$$

$$= \frac{\frac{1}{32}}{\frac{1}{32}+\frac{1}{16}} = \frac{\frac{1}{32}}{\frac{3}{32}} = \frac{1}{3}$$

Let the total pressure be P

The pressure exerted by oxygen (partial pressure) = $X_{O_2} \times P_{total}$

$$\Rightarrow P \times \frac{1}{3}$$

Hence, (3) is correct.

96. A 5.25 % solution of a substance is isotonic with a 1.5% solution of urea (molar mass = 60 g mol^{-1}) in the same solvent. If the densities of both the solutions are assumed to be equal to 1.0 g cm^{-3}, molar mass of the substance will be

(1) 90.0 g mol^{-1} (2) 115.0 g mol^{-1}
(3) 105.0 g mol^{-1} (4) 210.0 g mol^{-1}

Ans. (4)

Sol. Solutions with the same osmotic pressure are isotonic
Let the molar mass of the substance be M

$\pi_1 = C_1RT = C_2RT = \pi_2$

So, $C_1 = C_2$

As density of the solutions are same

So $\frac{5.25}{M} = \frac{15}{60}$

$M = \dfrac{5.25 \times 60}{1.5} = 210$

Hence (4) is correct

97. Assuming that water vapour is an ideal gas, the internal energy (ΔU) when 1 mol of water is vapourised at 1 bar pressure and 100°C, (Given: Molar enthalpy of vapourization of water at 1 bar and 373 K = 41 kJ mol^{-1} and R = 8.3 J mol^{-1}K^{-1}) will be

(1) 4.100 kJ mol^{-1}
(2) 3.7904 kJ mol^{-1}
(3) 37.904 kJ mol^{-1}
(4) 41. 00 kJ mol^{-1}

Ans. (3)

Sol. $H_2O(\ell) \xrightarrow{\text{vaporisation}} H_2O(g)$

$\Delta n_g = 1 - 0 = 1$

$\Delta H = \Delta U + \Delta n_g RT$

$\Delta U = \Delta H - \Delta n_g RT$

$= 41 - 8.3 \times 10^{-3} \times 373$

$= 37.9$ kJ mol^{-1}

Hence, (3) is correct.

98. In a sautrated solution of the sparingly soluble strong electrolyte $AgIO_3$ (Molecular mass = 283) the equilibrium which sets in is

$AgIO_{3(s)} \rightleftharpoons Ag^{+}_{(aq)} + IO^{-}_{3(aq)}$

If the solubility product constant K_{sp} of $AgIO_3$ at a given temperature is 1.0×10^{-8}, what is the mass of $AgIO_3$ contained in 100 ml of its saturated solution?

(1) 28.3×10^{-2} g
(2) 2.83×10^{-3} g
(3) 1.0×10^{-7} g
(4) 1.0×10^{-4} g

Ans. (2)

Sol. $AgIO_3(s) \rightleftharpoons Ag^{+}(aq) + IO_3^{-}(aq)$

Let the solubility of $AgIO_3$ be s

$K_{sp} = \left[Ag^{+}\right]\left[IO_3^{-}\right]$

$1.0 \times 10^{-8} = s^2$

$s = 10^{-4}$ mol/litre

$= \dfrac{10^{-4} \times 283}{1000} \times 100$

$= 283 \times 10^{-5}$

$= 2.83 \times 10^{-3}$ g/ 100 ml

Hence, (2) is correct.

99. A radioactive element gets spilled over the floor of a room. Its half-life period is 30 days. If the initial activity is ten times the permissible value, after how many days will it be safe to enter the room?

(1) 1000 days
(2) 300 days
(3) 10 days
(4) 100 days

Ans. (4)

Sol. Activity $\left(-\dfrac{dN}{dt}\right) \propto N$

$N = N_o \left(\dfrac{1}{2}\right)^n$

$\dfrac{N}{N_o} = \left(\dfrac{1}{2}\right)^n$

$\dfrac{1}{10} = \left(\dfrac{1}{2}\right)^n \Rightarrow 10 = 2^n$

log10 = nlog2

$\Rightarrow n = \dfrac{1}{0.301} = 3.32$

$t = n \times t_{112}$

= 3.32 × 30 = 99.6 days
Hence, (4) is correct.

100. Which one of the following conformation of cyclohexane is chiral?
(1) Twist boat (2) Rigid
(3) Chair (4) Boat

Ans. (1)
Sol. Twisted boat is chiral as it does not have plane of symmetry.
Hence, (1) is correct.

101. Which of the following is the correct order of decreasing SN^2 reactivity?
(1) $RCH_2X > R_3CX > R_2CHX$ (2) $RCH_2X > R_2CHX > R_3CX$
(3) $R_3CX > R_2CHX > RCH_2X$ (4) $R_2CHX > R_3CX > RCH_2X$
(X = a halogen)

Ans. (2)
Sol. More is the steric hindrance at the carbon bearing the halogen, lesser is the S_N2 reactivity.
Hence, (2) is correct.

102. In the following sequence of reactions,
$$CH_3CH_2OH \xrightarrow{P+I_2} A \xrightarrow[\text{ether}]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$$
the compound 'D' is
(1) butanal (2) n-butyl alcohol
(3) n-propyl alcohol (4) propanal

Ans. (3)
Sol.
$$\underset{}{CH_3CH_2OH} \xrightarrow{P+I_2} \underset{(A)}{CH_3CH_2I} \xrightarrow[\text{dry ether}]{Mg} \underset{(B)}{CH_3CH_2MgI}$$
$$\xrightarrow{\overset{H-C=O}{\underset{H}{|}}} \underset{(C)}{CH_3-CH_2-CH_2OMgI} \xrightarrow{H_2O} \underset{(D)}{CH_3CH_2CH_2OH} + Mg(OH)I$$
$\therefore$ the compound D is n-propyl alcohol.
Hence, (3) is correct option.

103. Which of the following sets of quantum numbers represents the highest energy of an atom?
(1) $n = 3, l = 2, m = 1, s = +1/2$ (2) $n = 3, l = 2, m = 1, s = +1/2$
(3) $n = 4, l = 0, m = 0, s = +1/2$ (4) $n = 3, l = 0, m = 0, s = +1/2$

Ans. (2)
Sol. (2) is the correct option because it has the maximum value of $n + \ell$
Hence, (2) is correct.

104. Which of the following hydrogen bonds is the strongest?
(1) O–H…….N (2) F–H…….F
(3) O–H…….O (4) O–H…….F

Ans. (2)
Sol. The hydrogen bond in HF is strongest, because fluorine is the most electronegative element.
Thus, (2) is the correct option.

105. In the reaction. $2Al_{(s)} + 6HCl_{(s)} \longrightarrow 2Al^{3+}{}_{(aq)} + 6Cl^{-}{}_{(aq)} + 3H_{2(g)}$,
(1) 6 L $HCl_{(aq)}$ is consumed for every 3L $H_{2(g)}$ produced
(2) 33.6 L $H_{2(g)}$ is produced regardless of temperature and pressure for every mole Al that reacts
(3) 67.2 L $H_{2(g)}$ at STP is produced for every mole Al that reacts
(4) 11.2 $H_{2(g)}$ at STP is produced for every mole $HCl_{(aq)}$ consumed

Ans. (4)
Sol. $2Al(s) + 6HCl(aq) \longrightarrow 2Al^{3+}(aq) + 6Cl^{-}(aq) + 3H_2(g)$
For each mole of HCl reacted, 0.5 mole of H_2 gas is formed at STP.
1 mole of an ideal gas occupies 22.4 lit at STP.
Volume of H_2 gas formed at STP per mole of HCl reacted is 22.4 × 0.5 litre
Hence, (4) is correct.

106. Regular use of which of the following fertilizer increases the acidity of soil?
(1) Potassium nitrate (2) Urea
(3) Superphosphate of lime (4) Ammonium sulphate

Ans. (4)

Sol. $(NH_4)_2\ SO_4$ is a salt of strong acid and weak base, on hydrolysis it ill produce H^+ ion. This will increase the acidity of soil.

$$(NH_4)_2\,SO_4 \longrightarrow 2NH_4^+ + SO_4^{2-}$$

$$NH_4^+ + H_2O \rightleftharpoons NH_4OH + H^+$$

Hence, (4) is correct answer.

107. Identify the correct statement regarding a spontaneous process
(1) For a spontaneous process in an isolated system, the change in entropy is positive
(2) Endothermic processes are never spontaneous
(3) Exothermic processes are always spontaneous
(4) Lowering of energy in the reaction process is the only criterion for spontaneity

Ans. (1)

Sol. For a spontaneous process in an isolated system, the change in entropy is positive.
Hence, (1) is correct.

108. Which of the following nuclear reactions will generate an isotope?
(1) neutron particle emission
(2) positron emission
(3) α-particle emission
(4) β-particle emission

Ans. (1)

Sol. $^{A}_{Z}X \longrightarrow {}^{A-1}_{Z}X + {}^{1}_{0}n$

Hence, (1) is correct.

109. The equivalent conductances of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at 25°C are given below:

$$\wedge^{\circ}_{CH_3COONa} = 91.0\ S\ cm^2/equiv$$

$$\wedge^{\circ}_{HCl} = 426.2\ S\ cm^2/equiv$$

What additional information/quantity one needs to calculate $\wedge^{\circ}$ of an aqueous solution of acetic acid?
(1) $\wedge^{\circ}$ of NaCl
(2) $\wedge^{\circ}$ of CH_3COOK
(3) The limiting equivalent conductance of $H^+ \left(\wedge^{\circ}_{H^+}\right)$
(4) $\wedge^{\circ}$ of chloroacetic acid (C/CH_2COOH)

Ans. (1)

Sol. From Kohlrausch's law

$$\Lambda^{\circ}_{CH_3COOH} = \Lambda^{\circ}_{CH_3COONa} + \Lambda^{\circ}_{HCl} - \Lambda^{\circ}_{NaCl}$$

Hence, (1) is the correct answer.

110. Which one of the following is the strongest base in aqueous solution?
(1) Trimethylamine
(2) Aniline
(3) Dimethylamine
(4) Methylamine

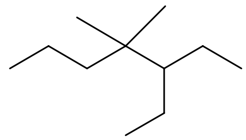
Ans. (3)

Sol. In aqueous solution basicity order of 1^o, 2^o and 3^o amine with methyl group is
$2^o > 1^o > 3^o$
In case of aniline lone pair of nitrogen is involved in resonance, so it is weaker base than aliphatic amines.
Hence, (3) is correct.

111. The compound formed as a result of oxidation of ethyl benzene by $KMnO_4$ is
(1) benzophenone
(2) acetophenone
(3) benzoic acid
(4) benzyl alcohol

Ans. (3)

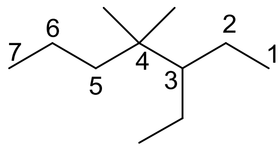
Sol. Any aliphatic carbon with hydrogen attached to it, in combination with benzene ring, will be oxidized to benzoic acid by $KMnO_4/H^+$.
Hence, (3) is correct.

112. The IUPAC name of  is

(1) 1, 1-diethyl-2,2-dimethylpentane
(2) 4, 4-dimethyl-5, 5-diethylpentane
(3) 5, 5-diethyl-4, 4-diemthylpentane
(4) 3-ethyl-4, 4-dimethylheptane

Ans. (4)

Sol.



The correct answer is 3-ethyl-4, 4-dimethylheptane.
Hence, (4) is correct.

113. Which of the following species exhibits the diamagnetic behaviour?

(1) O_2^{2-}
(2) O_2^{+}
(3) O_2
(4) NO

Ans. (1)

Sol. The correct option is O_2^{2-}

This species has 18 e⁻, which are filled in such a way that all molecular orbitals are fully filled, so diamagnetic.

$\sigma 1s^2 \sigma^* 1s^2, \sigma 2s^2 \sigma^* 2s^2, \sigma 2p_z^2, \pi 2p_x^2 = \pi 2p_y^2, \pi^* 2p_x^2 = \pi^* 2p_y^2$

Hence, (1) is correct.

114. The stability of dihalides of Si, Ge, Sn and Pb increases steadily in the sequence

(1) $GeX_2 \ll SiX_2 \ll SnX_2 \ll PbX_2$
(2) $SiX_2 \ll GeX_2 \ll PbX_2 \ll SnX_2$
(3) $SiX_2 \ll GeX_2 \ll SnX_2 \ll PbX_2$
(4) $PbX_2 \ll SnX_2 \ll GeX_2 \ll SiX_2$

Ans. (3)

Sol. Due to inert pair effect, the stability of +2 oxidation state increases as we move down this group.

$\therefore SiX_2 \ll GeX_2 \ll SnX_2 \ll PbX_2$

Hence, (3) is correct.

115. Identify the incorrect statement among the following

(1) Ozone reacts with SO_2 to give SO_3
(2) Silicon reacts with $NaOH_{(aq)}$ in the presence of air to give Na_2SiO_3 and H_2O
(3) Cl_2 reacts with excess of NH_3 to give N_2 and HCl
(4) Br_2 reacts with hot and strong NaOH solution to give NaBr, $NaBrO_4$ and H_2O

Ans. (4)

Sol. Br_2 reacts with hot and strong NaOH to give NaBr, $NaBrO_3$ and H_2O.
Hence, (4) is incorrect statement.

116. The charge/size ratio of a cation determines its polarizing power. Which one of the following sequences represents the increasing order of the polarizinig order of the polarizing power of the cationic species, K^+, Ca^{2+}, Mg^{2+}, Be^{2+}?

(1) $Mg^{2+}, Be^{2+}, K^+, Ca^{2+}$
(2) $Be^{2+}, K^+, Ca^{2+}, Mg^{2+}$
(3) $K^+, Ca^{2+}, Mg^{2+}, Be^{2+}$
(4) $Ca^{2+}, Mg^{2+}, Be^{2+}, K^+$

Ans. (3)

Sol. Higher the charge/size ratio, more is the polarizing power.

$\therefore K^+ < Ca^{2+} < Mg^{2+} < Be^{2+}$

Hence, (3) is correct.

117. The density (in g mL^{-1}) of a 3.60 M sulphuric acid solution that is 29% H_2SO_4 (Molar mass = 98 g mol^{-1}) by mass will be

(1) 1.64
(2) 1.88
(3) 1.22
(4) 1.45

Ans. (3)

Sol. Let the density of solution be ‘d’
Molarity of solution given = 3.6
i.e. 1 litre of solution contains 3.6 moles of H_2SO_4
or 1 litre of solution contains 3.6 × 98 gms of H_2SO_4
Since, the solution is 29% by mass.

100 gm solution contains 29 gm H_2SO_4

$\frac{100}{d}$ ml solution contains 29 gm of H_2SO_4

1000 ml solution contains 3.6 × 98 gm of H_2SO_4

$\therefore 3.6 \times 98 = \frac{29 \times d}{100} \times 1000$

d = 1.22

Hence, (3) is correct.

118. The first and second dissociation constants of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} respectively. The overall dissociation constant of the acid will be

(1) 5.0×10^{-5}
(2) 5.0×10^{15}
(3) 5.0×10^{-15}
(4) 0.0×10^{5}

Ans. (3)

Sol. $H_2A \rightleftharpoons HA^- + H^+$ $\quad K_1 = \frac{[HA^-][H^+]}{[H_2A]}$ ...(1)

$HA^- \rightleftharpoons H^+ + A^{2-}$ $\quad K_2 = \frac{[H^+][A^{2-}]}{[HA^-]}$ ...(2)

For the reaction

$H_2A \rightleftharpoons 2H^+ + A^{2-}$

$K = \frac{[H^+]^2[A^{2-}]}{[H_2A]} = K_1 \times K_2$

$= 1 \times 10^{-5} \times 5 \times 10^{-10}$

$= 5 \times 10^{-15}$

Hence, (3) is correct.

119. A mixture of ethyl alcohol and propyl alcohol has a vapour pressure of 290 mm at 300 K. The vapour pressure of propyl alcohol is 200 mm. If the mole fraction of ethyl alcohol is 0.6, its vapour pressure (in mm) at the same temperature will be

(1) 350
(2) 300
(3) 700
(4) 360

Ans. (1)

Sol. Let the vapour pressure of pure ethyl alcohol be P,

According to Raoult's law

290 = 200 × 0.4 + P × 0.6

$P = \frac{290 - 80}{0.6} = 350$ mm Hg

Hence, (1) is correct.

120. In conversion of lime-stone to lime,

$CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

the vales of $\Delta H°$ and $\Delta S°$ are +179.1 kJ mol^{-1} and 160.2 J/K respectively at 298 K and 1 bar. Assuming that $\Delta H°$ do not change with temperature, temperature above which conversion of limestone to lime will be spontaneous is

(1) 1008 K
(2) 1200
(3) 845 K
(4) 1118 K

Ans. (4)

Sol. We know, $\Delta G = \Delta H - T\Delta S$

So, lets find the equilibrium temperature, i.e. at which

$\Delta G = 0$

$\Delta H = T\Delta S$

$T = \frac{179.1 \times 1000}{160.2}$

= 1118 K

So, at temperature above this, the reaction will become spontaneous.

Hence, (4) is correct answer.