PART : CHEMISTRY

1. The ratio of spin only magnetic moments of the complexes $[Cr(CN)_6]^{3-}$ and $[Cr(H_2O)_6]^{3+}$ is :

Ans. (1)

Sol. $[Cr(CN)_6]^{3-}$ $\quad Cr^{+3} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$, $\mu = \sqrt{n(n+2)}$ BM

$$= \sqrt{3(3+2)} = \sqrt{15} \text{ BM}$$

$[Cr(H_2O)_6]^{3+}$ $\quad Cr^{+3} \rightarrow 3d^3 \Rightarrow t_{2g}^{1,1,1}\ e_g^{0,0}$, $\mu = \sqrt{n(n+2)}$ BM

$$= \sqrt{3(3+2)} = \sqrt{15} \text{ BM}$$

Ratio of magnetic moments = $\dfrac{\sqrt{15}}{\sqrt{15}} = 1$

2. If 25% (w/w) of 250 g of sugar solution & 40% (w/w) of 500 g sugar solution are mixed then calculate the mass percentage of the mixer solution.

Ans. (35)

Sol. Mass of sugar = $\dfrac{25}{100} \times 250 + \dfrac{40}{100} \times 500 \Rightarrow 262.5$ g

% w/w of solution = $\dfrac{262.5}{750} \times 100 = 35$ %

3. The correct increasing order of RMS velocity of Ne, Cl_2 and UF_6 present in a container at constant temperature is :

(1) $Ne > Cl_2 > UF_6$ (2) $Cl_2 > Ne > UF_6$
(3) $Ne > UF_6 > Cl_2$ (4) $UF_6 > Cl_2 > Ne$

Ans. (1)

Sol. $U_{RMS} = \sqrt{\dfrac{3RT}{M}}$

$U_{RMS} \propto \dfrac{1}{\sqrt{M}}$

$\therefore$ The correct increasing order of RMS velocities = $Ne > Cl_2 > UF_6$

4. The correct increasing order of first ionization enthalpy of Li, Be, C, B, N, O, F is :

(1) Li < Be < C < B < N < O < F
(2) Li < B < Be < C < O < N < F
(3) Li < Be < B < C < N < O < F
(4) Li < B < Be < C < N < O < F

Ans. (2)

Sol. The correct increasing order of first ionization enthalpies is

Li < B < Be < C < O < N < F

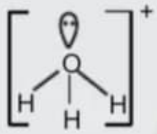
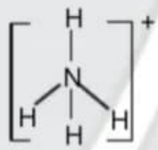
5. Match the following :

	Column-I		Column-I
(A)	Acetalide	(P)	Linear
(B)	H_3O^+	(Q)	Tetrahedral
(C)	NH_4^+	(R)	Bent
(D)	ClO_2^-	(S)	Pyramidal

(1) (A) → (P) ; (B) → (S) ; (C) → (Q) ; (D) → (R)
(2) (A) → (Q) ; (B) → (R) ; (C) → (P) ; (D) → (S)
(3) (A) → (R) ; (B) → (S) ; (C) → (Q) ; (D) → (P)
(4) (A) → (S) ; (B) → (Q) ; (C) → (R) ; (D) → (P)

Ans. **(1)**

Sol.

Molecule/Species	**Structure**	**Shape**
Acetalide	$H-C\equiv\bar{C}$	Linear
H_3O^+		Pyramidal
NH_4^+		Tetrahedral
ClO_2^-		Bent

6. $2Cu_2S + 3O_2 \longrightarrow 2Cu_2O + 2SO_2$
$2Cu_2O + Cu_2S \longrightarrow 6Cu + SO_2$
during this process obtained copper called as :
(1) Copper matte (2) Blister copper
(3) Reduced copper (4) Oxidised copper

Ans. **(2)**

Sol. During this process obtained copper has blistered appearance due to the evolution of SO_2 so it is called as blister copper.

7. Which of the following complex can show meridional isomerism :
(1) $[Co(en)_2Cl_2]$ (2) $[Co(en)_3]$ (3) $[Co(NH_3)_3(NO_2)_3]$ (4) $[Co(en)Cl_4]$

Ans. **(3)**

Sol. $[Ma_3b_3]$ can show facial and meridional isomerism.

8. $E^0_{Pb^{+2}|Pb} = M$, $E^0_{Pb^{4+}|Pb} = N$
$E^0_{Pb^{4+}|Pb^{2+}} = [M - X(N)]$, then value of X is_______ :

Ans. **(2)**

Sol. $Pb^{2+} + 2e^- \longrightarrow Pb$ $E_1^0 = M$; $\Delta G_1^0 = -2\ FM$

$Pb^{4+} + 4e^- \longrightarrow Pb$ $E_2^0 = N$; $\Delta G_2^0 = -4\ FM$

Target eq.

$Pb^{4+} + 2e^- \longrightarrow Pb^{2+}$ $E_3^0 = ?$; $\Delta G_3^0 = -2\ F E_3^0$

Target eq. = eq. 2 – eq 1

$-2F\ E_3^0 = -4FN - (-2FM)$

$E_3^0 = 2N - M = |M - 2N|$

X = 2

9. If K_2SO_4 (0.004 M) and Glucose (0.01 M) are isotonic. What will be the value of degree of dissociation for K_2SO_4.

Ans. **(75)**

Sol. Isotonic (Glucose) $i_2 = 1$

$i_1C_1 = i_2C_2$

$i_1 \times 0.004 = 1 \times 0.01$

$$i_1 = \frac{0.01}{0.004} \times \frac{1000}{100}$$

$$i_1 = \frac{10}{4} = \frac{5}{2} = 2.5$$

$i = 1 + (n - 1)\alpha$

$i = 1 + 2\alpha$

$2.5 = 1 + 2\alpha$

$\alpha = 0.75$

$\%\alpha = 75\ \%$

10. In which of the following set of ligands, all ligand not act as ambidentate ligand :

(1) $C_2O_4^{2-}$, H_2O, SCN^-

(2) $C_2O_4^{2-}$, NO_2^-, SCN^-

(3) $C_2O_4^{2-}$, en, SCN^-

(4) $EDTA^{4-}$, H_2O, dmg^-

Ans. **(4)**

Sol. Ligands which can ligate through two different sites present in it are called ambidentate ligands.

$EDTA^{4-}$, H_2O, dmg^- are not act as ambidentate ligand.

11. Initial concentration of a reaction is 10 mole/lit after 1 hour total concentration of reactant is 8.8 mole/lit, if rate constant of reaction is [X] × 10^{-6} mole/lit sec^{-1} , then value of X is______ [nearest integer]

Ans. **(333)**

Sol. On the basis of unit of rate constant reaction is zero order

	A $\longrightarrow$ Product
t = 0	10 mole/lit
t = 1 hour	8.8 mole/lit

For zero order reaction $C_t = C_0 - Kt$

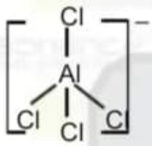
$8.8 = 10 - K \times 3600$

$$K = \left[\frac{10 - 8.8}{3600}\right] = 333.33 \times 10^{-6} \left(\frac{\text{mole}}{\text{lit sec}}\right)$$

12. Which of the following statement is correct for $GaAlCl_4$
(1) Oxidation state of Ga is +3
(2) Ga is surrounded by four Cl
(3) Al atom occupy all lattice point of CCP lattice.
(4) Chlorine atom is bounded with Al

Ans. (4)

Sol. Compound is $Ga^+[AlCl_4]^-$



13. For a solid edge length of solid 200 pm and density 3 gram/cm^3 and molecular mass of solid is 12 gram, then number of atom per unit cell is .... [Nearest integer] [Given $N_a = 6 \times 10^{23}$]

Ans. (1)

Sol. $d = \left\{\dfrac{Z \times M}{N_A \times a^3}\right\}$

$3 = \dfrac{Z \times 12}{6 \times 10^{23} \times (8 \times 10^{-24})}$

$Z = 1.2 \approx 1$

14. To 25 mL 1 M $AgNO_3$, 1.05 M KI is added drop wise then concentration of which ion is least in solution. [Take $AgNO_3$ excess]
(1) Ag^+ (2) I^- (3) K^+ (4) NO_3^-

Ans. (2)

Sol. $AgNO_3 + KI \longrightarrow AgI\downarrow + KNO_3(aq)$
Initially excess
So, concentration of I^- is least in concentration.

15. Which of the following is least soluble in water.
(1) $Fe_4[Fe(CN)_6]_3$ (2) $[Co(H_2O)_2(en)_2]Cl_3$
(3) $[Co(NH_3)_5Cl]Cl_2$ (4) $[Co(H_2O)_4Cl_2]Cl$

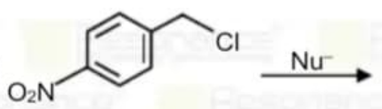
Ans. (1)

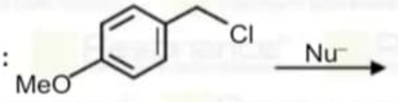
Sol. $Fe^{3+} + [Fe(CN)_6]^{4-} \longrightarrow \underset{\text{Least soluble}}{\underset{\text{"Prussion Blue"}}{Fe_4[Fe(CN)_6]_3\downarrow}}$

16. **Statement I :** It is 4 ppm BOD and concentration of dissolved O_2 is 8 ppm, then it is good quality water.
Statement II : It Zinc or Nitrate salt is more than 5 ppm, then it is not drinkable.
(1) Both Statement I and Statement II are correct
(2) Both Statement I and Statement II are incorrect
(3) Statement I is correct but Statement II is incorrect
(4) Statement I is incorrect but Statement II is correct

Ans. (1)

Sol. Clean water has BOD less than 5 ppm.

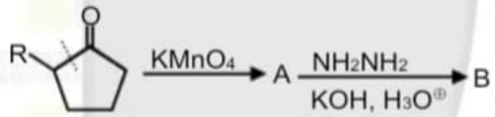
17. **Statement I :** 

Statement II : 

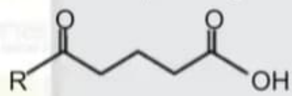
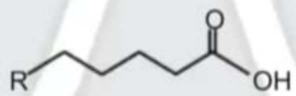
(1) Reaction in Statement I follow 1st order and in II follow 2nd order.
(2) Reaction in Statement I follow 2nd order and in II follow 1st order.
(3) Reaction in Statement I follow 1st order and in II follow 1st order.
(4) Reaction in Statement I follow 2nd order and in II follow 2nd order.

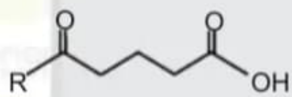
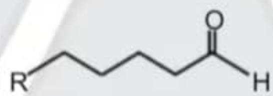
Ans. **(2)**

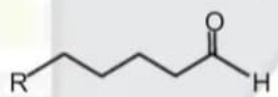
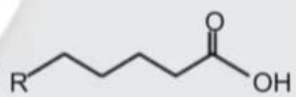
Sol. Reaction in Statement I follow 2nd order as carbocation is not stable where as Reaction in Statement II follow Ist order as carbocation is stabilized by +M effect of Methoxy group at para position.

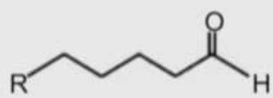
18. 

A and B are respectively.

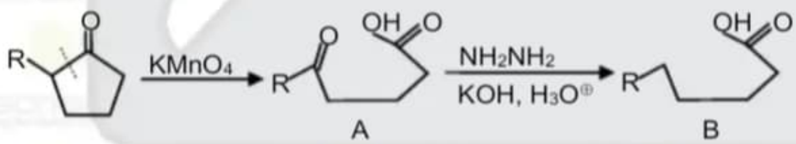
(1)  and 

(2)  and 

(3)  and 

(4)  and 

Ans. **(2)**

Sol. 

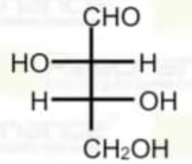
19. [X] is a polymer which has linear structure and no branch. [X] is prepared using titanium [IV] chloride and Aluminium (III) isopropoxide, then X is

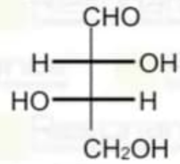
(1) Teflon (2) PAN (3) LDPE (4) HDPE

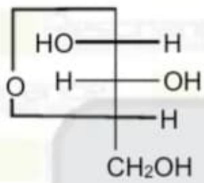
Ans. **(4)**

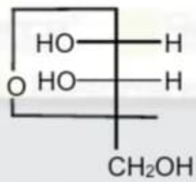
Sol. High density polythene has linear, unbranched structure and formation of HDPE requires Zeisler Natta catalyst ($TiCl_4$ $Al(O^{-}ipr)_3$).

20. L isomer of (C_4H_8O) gives shifts test, the compound is:

(1) 

(2) 

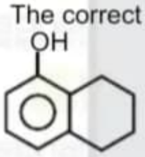
(3) 

(4) 

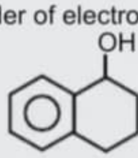
Ans. (2)

Sol. C_4H_8O has one DU, a, $\rangle C=O$ group and L in configuration, which is being satisfied by structure given in option (2)

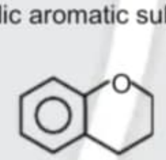
21. The correct order of electrophilic aromatic substitution of given compound is



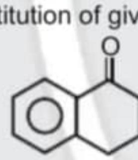
I



II



III

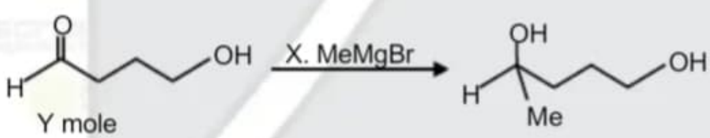


IV

(1) I > III > II > IV
(2) III > I > II > IV
(3) IV > I > II > III
(4) II > III > IV > I

Ans. (1)

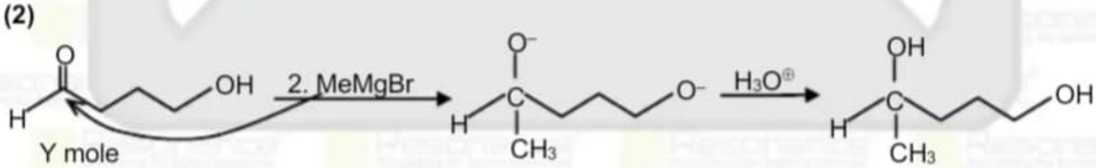
Sol. EAS in favoured on more electron rich benzene nuclei. The correct order of electron density in aromatic ring is I > III > II > IV.

22. 

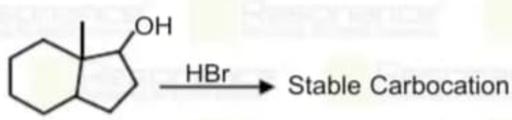
Y mole

Value of $\frac{X}{Y}$ is

Ans. (2)

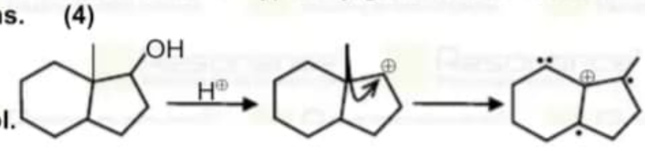
Sol. 

Y mole

23. 

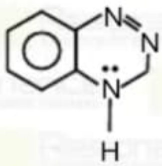
Find number of hypeconjugable **H** in carbocation?

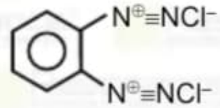
Ans. (4)

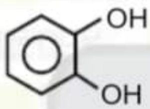
Sol. 

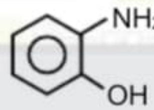
No. of hyperconjugable "H" atom in carbocation is 4.

24. o–Phenyl diamine $\xrightarrow{HNO_2}$ Product "P".
P is

(1) 

(2) 

(3) 

(4) 

Ans. **(1)**

Sol.