# CHEMISTRY
# JEE-MAIN (July-Attempt)
# 29 July (Shift-2) Paper Solution

## SECTION - A

**1.** Consider the reaction

$4HNO_3(l) + 3KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3(s)$

The amount of $HNO_3$ required to produce 110.0 g of $KNO_3$ is

(Given : Atomic masses of H, O, N and K are 1, 16, 14 and 39, respectively.)

(A) 32.2 g (B) 69.4 g (C) 91.5 g (D) 162.5 g

Sol. **C**

$4HNO_3(\ell) + 3KCl(s) \rightarrow Cl_2(g) + NOCl(g) + 2H_2O(g) + 3KNO_3$

Moles of $HNO_3 = \frac{4}{3} \times \frac{110}{101}$

Mass of $HNO_3 = \frac{4}{3} \times \frac{110}{101} \times 63$

$= 91.485$ g

mass = 110

Molecular mass = $39 \times 1 + 14 \times 1 + 16 \times 3$

$= 39 + 14 + 48$

$= 39 + 62$

$= 101$

Moles $= \frac{110}{101}$

**2.** Given below are the quantum numbers for 4 electrons.

A. $n = 3, l = 2, m_l = 1, m_s = +1/2$

B. $n = 4, l = 1, m_l = 0, m_s = +1/2$

C. $n = 4, l = 2, m_l = -2, m_s = -1/2$

D. $n = 3, l = 1, m_l = 1, m_s = +1/2$

The correct order of increasing energy is

(A) D < B < A < C (B) D < A < B < C (C) B < D < A < C (D) B < D < C < A

Sol. **(B)**

Greater the value of $(n+\ell)$ grater is energy.

**3.** $C(s) + O_2(g) \rightarrow CO_2(g) + 400$ kJ

$C(s) + \frac{1}{2}O_2(g) \rightarrow CO(g) + 100$ kJ

When coal of purity 60% is allowed to burn in presence of insufficient oxygen, 60% of carbon is converted into 'CO' and the remaining is converted into '$CO_2$'. The heat generated when 0.6 kg of coal is burnt is _____.

(A) 1600 kJ (B) 3200 kJ (C) 4400 kJ (D) 6600 kJ

Sol. **D**

$C_{(s)} + \frac{1}{2}O_2(g) \rightarrow CO_{(g)}; \Delta H = -100$KJ/mole

$C(s) + O_2(g) \rightarrow CO_2(g); \Delta H = -400$KJ/mole

Mass of carbon $= (0.6 \times 10^3)\frac{60}{100} = \frac{600 \times 60}{100} = 360$gram

60% of carbon $\Rightarrow \frac{360 \times 60}{100} = 216$gram

(1) $C_{(s)} + \frac{1}{2}O_2 \rightarrow CO(g); \Delta H = -100KJ/mole$

$\left(\frac{216}{12}\right)$ $\Delta H = -100 \times \frac{216}{12} = -1800$ KJ

(2) $C_{(s)} + O_2 \rightarrow CO_2(g); \Delta H - 400KJ/mole$

$\left(\frac{144}{12}\right)$ $\Delta H = -400 \times \frac{144}{12} = -4800KJ$

Total heat released = 1800 + 4800 = 6600 KJ

**4.** 200 mL of 0.01 M HCl is mixed with 400 mL of 0.01 M $H_2SO_4$. The pH of the mixture is ___.
Given : $\log 2 = 0.30, \log 3 = 0.48. \log 5 = 70, \log 7 = 0.84, \log 11 = 1.04$
(A) 1.14 (B) 1.78 (C) 2.34 (D) 3.02

Sol. **(B)**

$[H^+] = \frac{0.01\times200+2\times0.01\times400}{600} \Rightarrow \frac{5}{3}\times10^{-2}$

pH = –log $[H^+]$

$= -\log\left(\frac{5}{3}\times10^{-2}\right)$

$= -\left[\log\frac{5}{3}+\log10^{-2}\right]$

$= -[\log5 - \log3 - 2]$

= –0.7 + 0.48 + 2

= 2.48 – 0.7

= 1.78

**5.** Given below are the critical temperature of some of the gases :

| Gas | Critical temperature (K) |
|---|---|
| He | 5.2 |
| $CH_4$ | 190.0 |
| $CO_2$ | 304.2 |
| $NH_3$ | 405.5 |

The gas showing least adsorption on a definite amount of charcoal is
(A) He (B) $CH_4$ (C) $CO_2$ (D) $NH_3$

Sol. **(A)**

Greater the value of critical temperature greater is adsorptioin as 'He' has least critical temperature so it is absorb least.

**6.** In liquation process used for tin (Sn), the metal
(A) Is reacted with acid.
(B) Is dissolved in water.
(C) Is brought to molten form which is made to flow on a slop.
(D) is fused with NaOH

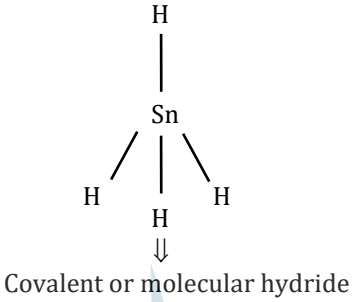
Sol. **C**

**Liquation process : -** In this method, a low melting metal tin can be made to flow on a sloping surface. In this way it is Separated from higher melting impurities so correct option is (C)

**7.** Given below are two statements.
Statement I : Stannane is an example of a molecular hydride.
Statement II : Stannane is a planar molecule.
In the light of the above statement, choose the most appropriate answer form the option given below.
(A) Both Statement I and Statement II are true.
(B) Both Statement I and Statement II are false.
(C) Statement I true but Statement II is false.
(D) Statement I is false but Statement II is true.

Sol. **C**

Stannae → it is an inorganic compound
→ it is tin hydride or tin tetra hydride




→ molecular hydride
→ But it not planar so it is tetrahedral
Option (C)

**8.** Portland cement contains 'X' to enhance the setting time. What is 'X' ?
(A) $CaSO_4 . \frac{1}{2} H_2O$ (B) $CaSO_4 . 2H_2O$ (C) $CaSO_4$ (D) $CaSO_3$

Sol. **B**

Setting of cement : when mixed water, the setting of cement takes place to give a hand mass the is due to the hydration of the molecules of the constituents and their rearrangements
gypsum is added to enhance the setting time gypsum : - $CaSO_4 . 2H_2$ Option (B)

**9.** When borax is heated with CoO on a platinum loop, blue coloured bead formed is largely due to
(A) $B_2O_3$ (B) $Co(BO_2)_2$ (C) $CoB_4O_7$ (D) $Co[B_4O_5(OH)_4]$

Sol. **B**

Borax Bead Test : - Borax on strongly heating gives transparent glassy bead.
When this bead is placed on CoO solution and then it placed in a flame
→ We will find blue colour
→ This blue colour is due to the following reaching

$Na_2B_4O_7 . 10H_2O \xrightarrow{\Delta} Na_2B_4O_7 + 10H_2O$

$Na_2B_4O_7 \xrightarrow{\Delta} NaBO_2 + B_2O_3$

$CoO + B_2O_3 \xrightarrow{\Delta} Co(BO_2)_2$

Cobalt II meta borate (blue)

Option (B)

**10.** Which of the following 3d-metal ion will give the lowest enthalpy of hydration $(\Delta_{hyd}H)$ when dissolved in water ?

(A) $Cr^{2+}$ (B) $Mn^{2+}$ (C) $Fe^{2+}$ (D) $Co^{2+}$

Sol. **B**

→ Generally hydration energy increases with increase in charge

→ and decreases with increase in radius

→ d block elements also follow similar trend with some exceptions

| Ions | hydration enthalpy |
|---|---|
| $Cr^{2+}$ = | – 1925 KJ/mol |
| $Mn^{2+}$ = | – 1862 KJ/mol |
| $Fe^{2+}$ = | – 1998 KJ/mol |
| $Co^{2+}$ = | – 2079 KJ/mol |

Option (B)

**11.** Octahedral complexes of copper(II) undergo structural distortion (Jahn-Teller).

Which one of the given copper (II) complexes will show the maximum structural distortion ?

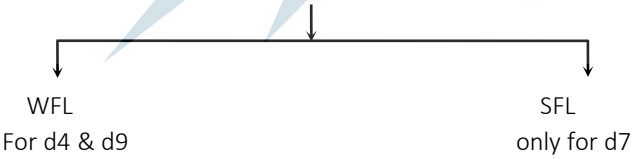
(en-ethylenediamine; $H_2N-CH_2-CH_2-NH_2$)

(A) $[Cu(H_2O)_6]SO_4$ (B) $[Cu(en)(H_2O)_4]SO_4$

(C) cis $-[Cu(en)_2Cl_2]$ (D) trans $-[Cu(en)_2Cl_2]$

Sol. **A**

Jahn-Teller distortion is seen in octahedral complex




→ Now if we see above, in all option we have $cu^{2+}$ → which means it has d9

→ So that compound which contains W.F.L will show more distortion

Option (A)

**12.** Dinitrogen is a robust compound, but reacts at high altitudes to form oxides. The oxide of nitrogen that can damage plant leaves and retard photosynthesis is

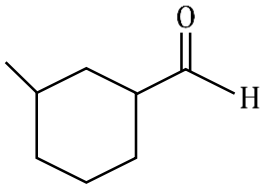
(A) NO (B) $NO_3^-$ (C) $NO_2$ (D) $NO_2^-$

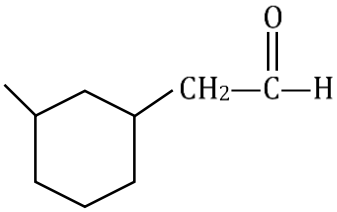
Sol. **C**

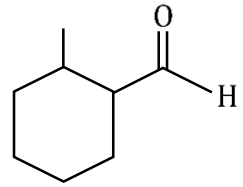
Higher concentration of $NO_2$ damage the leaves of plant and retard the rate of photosynthesis.

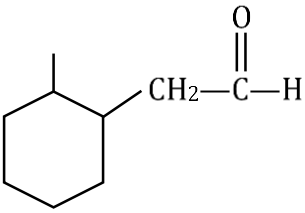
Option (C)

**13.** Correct structure of γ − methylcyclohexane carbaldehyde is

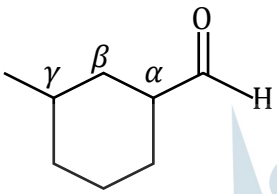
(A) 

(B) 

(C) 

(D) 

Sol. **A**

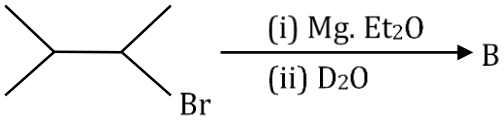


Methyle group at $\gamma$ − position

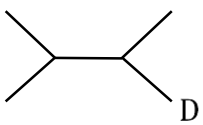
$\gamma$- methylcyclohexane carboldehyde

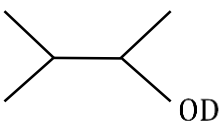
**14.** Compound 'A' undergoes following sequence of reactions to give compound 'B'. The correct structure and chirality of compound 'B' is

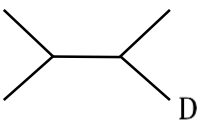
[where Et is $-C_2H_5$]

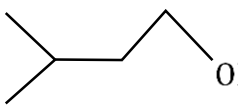


Compound 'A'

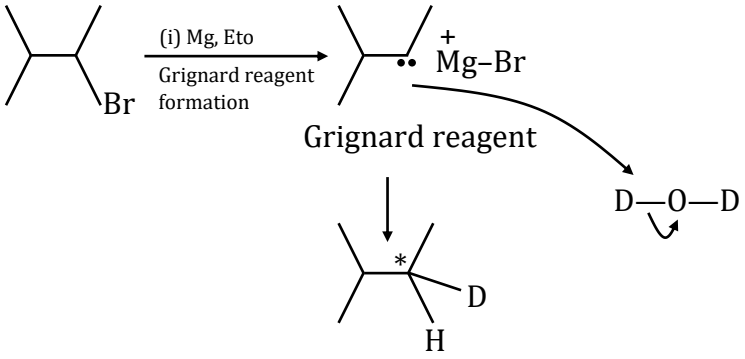
(A)  , Achiral

(B)  ,Chiral

(C)  , Chiral

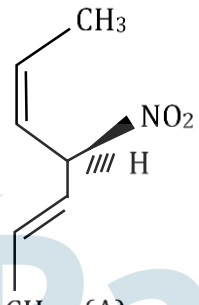
(D)  , Achiral

Sol. **C**

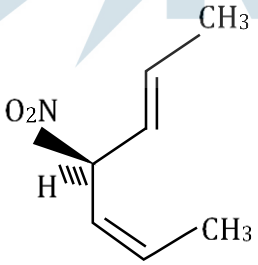



Now marked carbon become assymetric (chiral) carbon hence, Molecule become chiral.

**15.** Given below are two statements.

Statement I : The compound  is optically active.



Statement II :  is mirror image of above compound A.



In the light of the above statement, choose the most appropriate answer from the options given below

(A) Both Statement I and Statement II are correct.

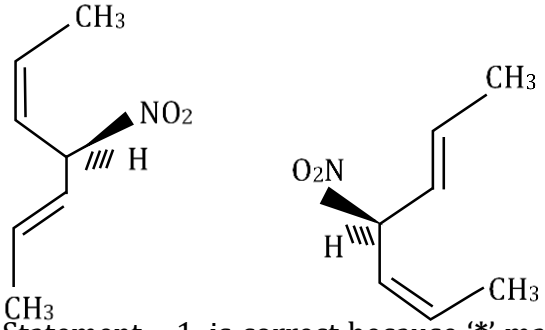
(B) Both Statement I and Statement II are incorrect.

(C) Statement I is correct but Statement II are incorrect.

(D) Statement I is incorrect but Statement II is correct.

Sol. **C**

Given below are two statements



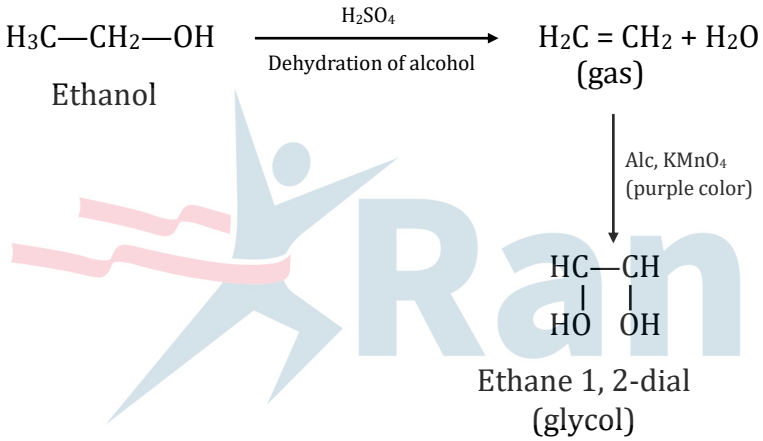
Statement – 1, is correct because '*' marked carbon is attached to 4 different group, $-NO_2$, –H, Cis–alkene, trans alkene. Hence molecule is chiral and opticaly active.

Statement – 2, is incorrect compound II is not mirror image of compound A.

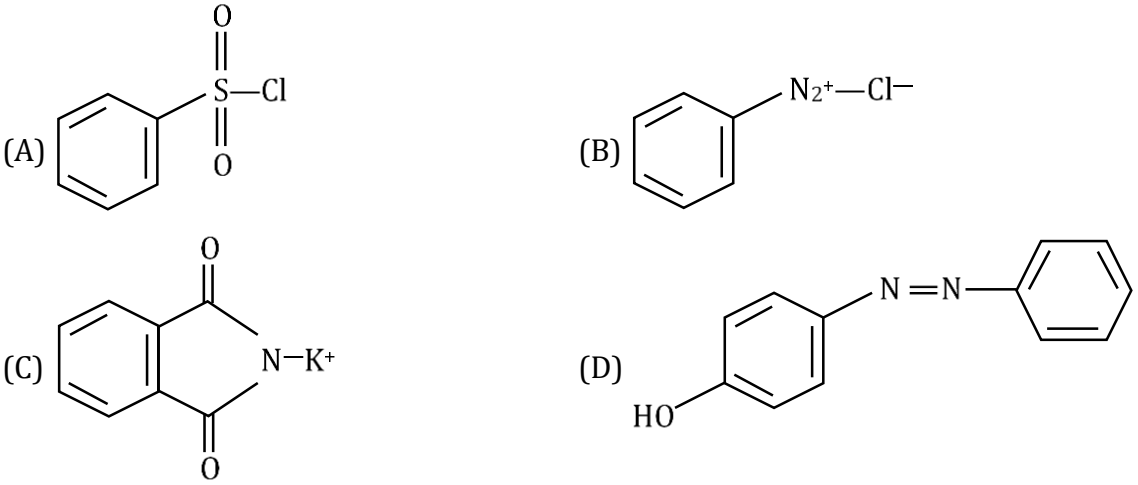
**16.** When enthanol is heated with conc. $H_2SO_4$, a gas is produced. The compound formed, when this gas is treated with cold dilute aqueous solution of Baeyer's reagent, is

(A) Formaldehyde (B) Formic acid (C) Glycol (D) Ethanoic acid

Sol. **C**

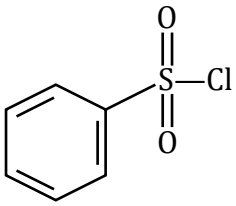



**17.** The Hinsberg reagent is



Sol. **A**

Hinsberg reagent



Benzene sulfonyl chloride is called Hinsberg reagent it is used to detect primary, secondary and teritary amine.

**18.** Which of the following is NOT a natural polymer ?

(A) Protein (B) Starch (C) Rubber (D) Rayon

Sol. **D**

Rayon is not a natural polymer.

**19.** Given below are two statements. One is labelled as Assertion A and the other is labelled as Reason R.

Assertion A : Amylose is insoluble in water.

Reason R : Amylose is a long linear molecule with more than 200 glucose units.

In the light of the above statements, choose the correct answer from the options given below

(A) Both A and R correct and R is the correct explanation of A.

(B) Both A and R correct but R is NOT the correct explanation of A.

(C) A is correct but R is not correct.

(D) A is not correct but R is correct

Sol. **D**

Asseration A : Amylose is insoluble in water.

Reason R : Amylose is a long linear molecular.

A is not correct but R is correct. Amylose is soluble in water, and amylose is long linear molecule with more than 200 glucose.

**20.** A compound 'X' is a weak acid and it exhibits colour change at pH close to the equivalence point during neutralization of NaOH with $CH_3COOH$. Compound 'X' exists in ionized form in basic medium. The compound 'X' is

(A) Methyl orange (B) Methyl red

(C) Phenolphthalein (D) Erichrome Black T

Sol. **(C)**

Weak acid ⇒ pH must be between 8 – 10

## SECTION - B

**21.** 'x' g of molecular oxygen ($O_2$) is mixed with 200 g of neon (Ne). The total pressure of the non-reactive mixture of $O_2$ and Ne in the cylinder is 25 bar. The partial pressure of Ne is 20 bar at the same temperature and volume. The value of 'x' is ___.
[Given : Molar mass of $O_2 = 32$ g mol$^{-1}$.
Molar mass of Ne $= 20$ g mol$^{-1}$]

Sol. **(80)**

$P_{Ne} = P_{total} \times X_{Ne}$

$\Rightarrow 20 = 25 \times X_{Ne}$

$[X_{Ne}] = \frac{20}{25} = \frac{4}{5}$

$\Rightarrow \left[\frac{\frac{200}{20}}{\frac{200}{20}+\frac{x}{32}}\right] = \frac{4}{5}$

$\Rightarrow \frac{10}{10+\frac{x}{32}} = \frac{4}{5}$

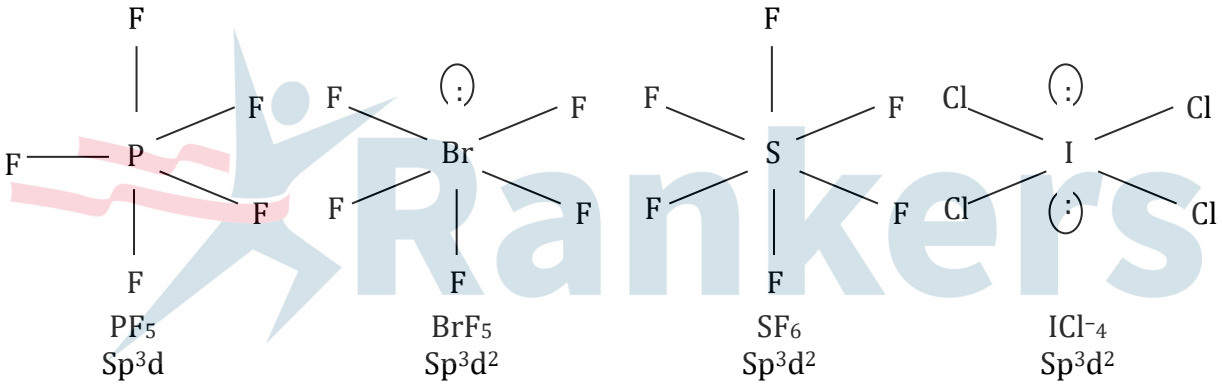
$\Rightarrow 400 = 320 + x$

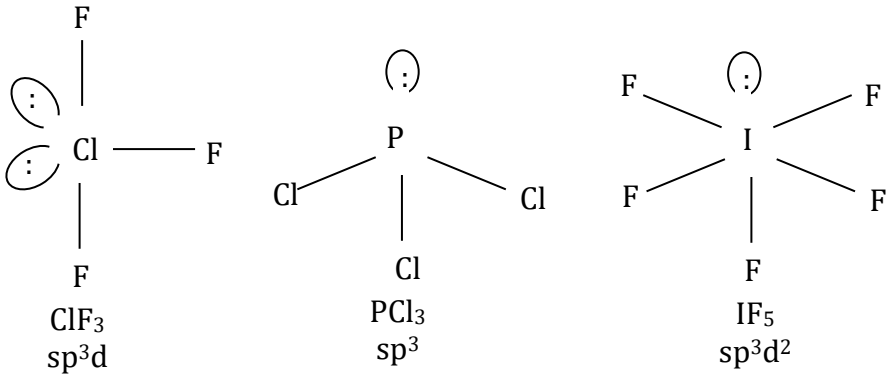
$\Rightarrow x = 80$

**22.** Consider, $PF_5$, $BrF_5$, $PCl_3$, $SF_6$, $[ICl_4]^-$, $ClF_3$ and $IF_5$.
Amongst the above molecules(s)/ion(s), the number of molecule(s)/ion(s) having $sp^3d^2$ hybridisation is _____.

Sol. **4**

The structure are below –




| $ClF_3$ | $PCl_3$ | $IF_5$ |
|---|---|---|
| $sp^3d$ | $sp^3$ | $sp^3d^2$ |

total = 4

sp3d2 :- $\boxed{\sigma + l.P} \Rightarrow 6$

The concept of hybridisation is for σ bond and lone pair

**23.** 1.80 g of solute A was dissolved in 62.5 $cm^3$ of ethanol and freezing point of the solution was found to be 155.1 K. The molar mass of solute A is ____ g $mol^{-1}$.
[Given : Freezing point of ethanol is 156.0 K.
Denstiy of ethanol is 0.80 g $cm^{-3}$.
Freezing point depression constant of ethanol is 2.00 K kg $mol^{-1}$]

Sol. **(80)**

Mass of solvent = $d \times v = 0.8 \times 62.5$
= 50 g

$\Delta T_f = K_f \times m$

$0.9 = 2\left[\frac{1.8\times1000}{M_{solute}\times50}\right]$

$M_{solute}$ = 80 g/ mole

**24.** For a cell, Cu(s)|$Cu^{2+}$(0.001M)||$Ag^+$(0.01M)|Ag(s) the cell potential is found to be 0.43 V at 298 K. The magnitude of standard electrode potential for $Cu^{2+}$/Cu __ $\times 10^{-2}$V.
$\left|\text{Given : } E^{\ominus}_{Ag^+/Ag} = 0.80V \text{ and } \frac{2.303RT}{F} = 0.06\ V\right|$

Sol.

Anode : $Cu(s) \rightarrow Cu^{2+}(aq) + 2e^-$
Cathode : $[Ag^+ + e^- \rightarrow Ag(s)] \times 2$

$Cu(s) + 2Ag^+(aq.) \rightarrow Cu^{2+}(aq.) + 2Ag(s)$

$E_{cell} = E^0_{cell} - \frac{0.06}{2}\log\frac{[Cu^{2+}]}{[Ag^+]^2}$

$0.43 = E^0_{cell} - \frac{0.06}{2}\log\left(\frac{10^{-3}}{10^{-2}}\right)^2$

$0.43 = E^0_{cell} - 0.03\log10$

$E^0_{cell} = 0.46V$

$E^0_{cell} = E^0_{Ag^+/Ag} - E^0_{Cu^{2+}/Cu}$

$E^0_{Cu^{2+}/Cu} = (0.80 - 0.46) = 0.34V = 34 \times 10^{-2}$

**25.** Assuming 1μg of trace radioactive element X with a half life of 30 years is absorbed by a growing tree. The amount of X remaining in the tree after 100 years is ____$\times 10^{-1}$μg.
[Given : ln = 2.303 ; log 2 = 0.30]

Sol. **(1)**

$t = \frac{1}{\lambda}\ln\left(\frac{a}{a-x}\right)$

$100 = \left(\frac{30}{\log2}\right)\left[\ln\left(\frac{1}{\omega}\right)\right]$

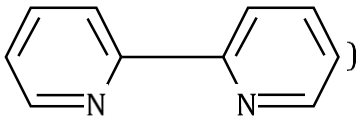
$\frac{100\times\log2}{30} = \log\left(\frac{1}{\omega}\right)$

$1 = \log\left(\frac{1}{\omega}\right)$

$\frac{1}{\omega} = 10$

$\omega = 0.1$ μg

**26.** Sum of oxidation state (magnitude) and coordination number of cobalt in $Na[Co(bpy)Cl_4]$ is _____.

(Given : bpy =  )

**Sol.** **9**

Coordination no. = 6

Oxidation state = 3

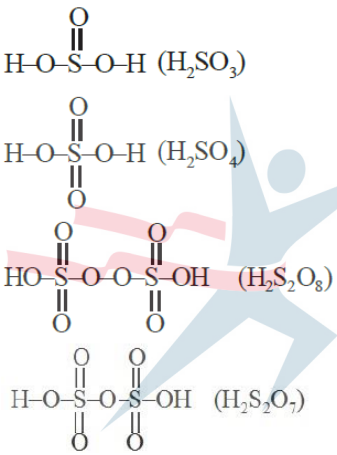
6 + 3 = 9

**27.** Consider the following Sulphur based oxoacids.

$H_2SO_3$, $H_2SO_4$, $H_2S_2O_8$ and $H_2S_2O_7$

Amongst these oxoacids, the number of those with peroxo $(O-O)$ bond is_____.

Sol. 1




**28.** A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0 g/mol gave 1.344 mL of $H_2$ gas at STP. The number of alcoholic hydrogens present in compound 'X' is_____.

**Sol.** **6**

Mole of $H_2$ gas $= \frac{1.344}{22400} = 6 \times 10^{-5}$

No. of H–atoms per molecule of $H_2$ = 2

Moles of alcoholic hydrogens = $6 \times 10^{-5} \times 2$

$n \times \frac{1.84 \times 10^{-3}}{92} = 2 \times 6 \times 10^{-5}$

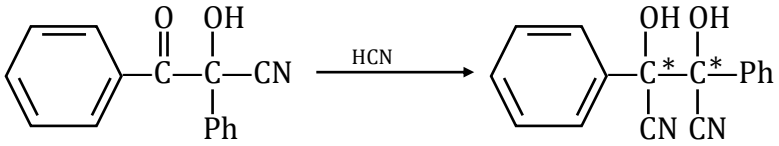
$n = \frac{12 \times 92}{184} \quad \Rightarrow 6$

**29.** The number of stereoisomers formed in a reaction of $(\pm)Ph(C=O)C(OH)(CN)Ph$ with HCN is_____.

[Where Ph is $-C_6H_5$]

Sol. **3**

The number of stereoisomer formed in a reaction.




Two chiral centre

n = 2

No. of chiral centre = 2

No. of stereisomer $= 2^n - 2^{\frac{n}{2}-1}$

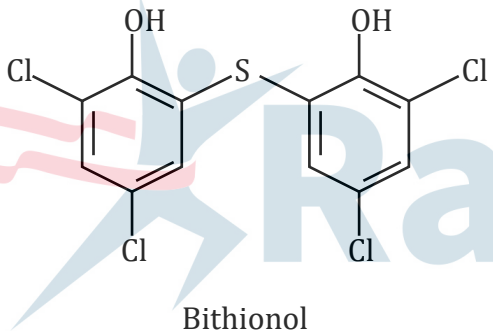
$= 2^2 - 2^{\frac{2}{2}-1}$

$2^2 - 2^0$

No. of stereisomer = 3

**30.** The number of chlorine atoms in bithionol is ____.

**Sol.** **4**




Bithionol

No. of chlorine atom = 4