Sol. In resultant solution

$n_{NH_3} = 0.1 - 0.02 = 0.08$

$n_{NH_4Cl} = n_{NH_4^+} = 0.1 + 0.02 = 0.12$

$$pOH = pK_b + \log\frac{[NH_4^+]}{[NH_3]}$$

$$= 4.745 + \log\frac{0.12}{0.08}$$

$$= 4.745 + \log\frac{3}{2}$$

$= 4.745 + 0.477 - 0.301$

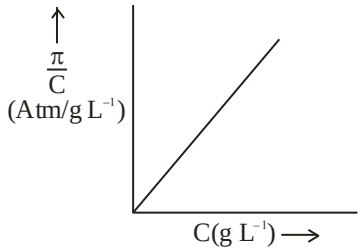
$pOH = 4.921$

$pH = 14 - pH$

$= 9.079$

53. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph.

The molar mass of PVC is_____g mol^{-1} (Nearest integer)



(Given : R = 0.083 L atm K^{-1} mol^{-1})

Official Ans. by NTA (41500)

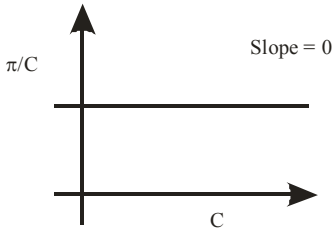
Ans. (Bonus/41500)

Sol. $$\pi = M'RT = \left(\frac{W/M}{V}\right)RT$$

$$\Rightarrow \quad \pi = \left(\frac{W}{V}\right)\left(\frac{1}{M}\right)RT = C\left(\frac{RT}{M}\right)$$

$$\Rightarrow \quad \frac{\pi}{C} = \frac{RT}{M} \neq f(c)$$

If we assume graph between $\frac{\pi}{C}$ and C



Assuming π vs C graph

$$\text{Slope} = \frac{RT}{M} = \frac{0.083 \times 300}{M} = 6 \times 10^{-4}$$

$$\therefore \quad M = \frac{0.083 \times 300}{6 \times 10^{-4}} = \frac{830 \times 300}{6}$$

= 41,500 gm/mole

54. How many of the following metal ions have similar value of spin only magnetic moment in gaseous state ?_____

(Given: Atomic number : V, 23 ; Cr, 24 ; Fe, 26 ; Ni, 28)

V^{3+}. Cr^{3+}, Fe^{2+}, Ni^{3+}

Official Ans. by NTA (2)

Ans. (2)

Sol. $\mu_s = \sqrt{n(n+2)}BM$ (n=no. of unpaired electrons)

	n
V^{3+} : [Ar] $3d^2 4s^0$	2
Cr^{3+} : [Ar] $3d^3 4s^0$	3
Fe^{2+} : [Ar] $3d^6 4s^0$	4
Ni^{3+} : [Ar] $3d^7 4s^0$	3

Cr^{3+}& Ni^{3+} have same value of μ_s

55. The density of a monobasic strong acid (Molar mass 24.2 g mol) is 1.21 kg L. The volume of its solution required for the complete neutralization of 25 mL of 0.24 M NaOH is_____ × 10^{-2} mL (Nearest integer)

Official Ans. by NTA (12)

Ans. (12)

Sol. millimole of NaOH = 0.24 × 25

$\therefore$ millimole of acid = 0.24 × 25

$\Rightarrow$ mass of acid = 0.24 × 25 × 24.2 mg

for pure acid,

$$V = \frac{w}{d};\ (d = 1.21\ kg/L\ = 1.21\ g/ml)$$

$$\therefore V = \frac{0.24 \times 25 \times 24.2}{1.12} \times 10^{-3}$$

$= 120 \times 10^{-3}$ ml

$= 12 \times 10^{-2}$ ml

56. For the first order reaction A $\rightarrow$ B Br the half life is 30 mm. The time taken for 75% completion of the reaction is_____mm. (Nearest mteger)

Given : log 2 = 0.3010

log 3 = 0.4771

log 5 = 0.6989

Official Ans. by NTA (60)

Ans. (60)

Sol. $t_{1/2} = T_{50} = 30$ min

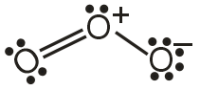
$T_{75} = 2t_{1/2} = 30 \times 2 = 60$ min

57. The total number of lone pairs of electrons on oxygen atoms of ozone is_____

Official Ans. by NTA (6)

Ans. (6)

Sol. (Total no, of lone pairs on oxygen atoms = 6



58. In sulphur estimation. 0.471 g of an organic compound gave 1.4439 g of barium sulphate.

The percentage of sulphur in the compound is_____(Nearest Integer)

(Given: Atomic mass Ba: 137 u: S: 32 u, O: 16 u)

Official Ans. by NTA (42)

Ans. (42)

Sol

$$\%\text{sulphur} = \frac{32}{233} \times \frac{\text{weight of } BaSO_4 \text{formed}}{\text{weight of organic compound}} \times 100$$

$$= \frac{32}{233} \times \frac{1.4439}{0.471} \times 100$$

$= 42.10$

Nearest integer 42

59. The number of paramagnetic species from the following is_____.

$[Ni(CN)_4]^{2-}$, $[Ni(CO)_4]$, $[NiCl_4]^{2-}$

$[Fe(CN)_6]^{4-}$, $[Cu(NH_3)_4]^{2+}$

$[Fe(CN)_6]^{3-}$ and $[Fe(H_2O)_6]^{2+}$

Official Ans. by NTA (4)

Ans. (4)

Sol. $\left[Ni(CN)_4\right]^{2-}: Ni^{+2} = \overset{3d^8}{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\ }}$:

diamagnetic

^-CN : strong field ligand

$\left[Ni(CO)_4\right]: Ni = \overset{3d^{10}}{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}}$:diamagnetic

$\left[NiCl_4\right]^{2-}: Ni^{2+} = \overset{3d^8}{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{1}\boxed{1}}$:paramagnetic

Cl^- : weak field ligand

$\left[Fe(CN)_6\right]^{4-}: Fe^{2+} \overset{3d^6}{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{\ }\boxed{\ }}$:diamagnetic

^-CN : strong field ligand

$[Cu(NH_3)_4]^{+2}$: Cu^{+2} $\Rightarrow$ one unpaired electron : paramagnetic

$[Fe(CN)_6]^{3-}$: Fe^{+3} : $\overset{3d^5}{\boxed{\uparrow\downarrow}\boxed{\uparrow\downarrow}\boxed{1}\boxed{\ }\boxed{\ }}$: paramagnetic, ^-CN : strong field ligand

$[Fe(H_2O)_6]^{2+}$: Fe^{2+} : $\overset{3d^6}{\boxed{\uparrow\downarrow}\boxed{1}\boxed{1}\boxed{1}\boxed{1}}$: paramagnetic H_2O : Weak field ligand

60. Consider the cell

$$Pt(s)\left|H_2(s)(1atm)\right|H^+(aq,[H^+]=1)\left\|Fe^{3+}(aq),Fe^{2+}(aq)\right|Pt(s)$$

Given : $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771V$ and $E^\circ_{H^+/\frac{1}{2}H_2} = 0V, T = 298K$

If the potential of the cell is 0.712 V the ratio of concentration of Fe^{2+} to Fe^{2+} is_____(Nearest integer)

Official Ans. by NTA (10)

Ans. (10)

Sol. $\frac{1}{2}H_2(g) + Fe^{3+}(aq.) \longrightarrow H^+(aq) + Fe^{2+}(aq.)$

$$E = E^o - \frac{0.059}{1}\log\frac{[Fe^{2+}]}{[Fe^{3+}]}$$

$$\Rightarrow \quad 0.712 = (0.771-0) - \frac{0.059}{1}\log\frac{[Fe^{2+}]}{[Fe^{3+}]}$$

$$\Rightarrow \quad \log\frac{[Fe^{2+}]}{[Fe^{3+}]} = \frac{(0.771-0712)}{0.059} = 1$$

$$\Rightarrow \quad \frac{[Fe^{2+}]}{[Fe^{3+}]} = 10$$