JEE–MAIN EXAMINATION – JANUARY 2026

(HELD ON SATURDAY 24th JANUARY 2026) **TIME : 9:00 AM TO 12:00 NOON**

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

51. Given below are two statements :

Statement-I Hybridisation, shape and spin only magnetic moment of $K_3[Co(CO_3)_3]$ is sp^3d^2, octahedral and 4.9 BM respectively.

Statement-II Geometry, hybridisation and spin only magnetic moment values (BM) of the ions $[Ni(CN)_4]^{2-}$, $[MnBr_4]^{2-}$ and $[CoF_6]^{3-}$ respectively are square planar, tetrahedral, octahedral : dsp^2, sp^3, sp^3d^2 and 0, 5.9, 4.9.

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

(1) Both statement-I and statement-II are false

(2) Statement I is false but statement-II is true

(3) Both statement-I and statement-II are true

(4) Statement-I is true but statement-II is false

Ans. **(3)**

Sol. In $K_3[Co(CO_3)_3] \Rightarrow sp^3d^2$ hybridized, octahedral

$\Rightarrow$ 4 unpaired electron

$\Rightarrow$ 4.9 B.M.

$[Ni(CN)_4]^{2-} \Rightarrow dsp^2$ hybridized , square planar

$\Rightarrow$ 0 unpaired electron

$\Rightarrow$ 0 B.M.

$[MnBr_4]^{2-} \Rightarrow sp^3$ hybridized , tetrahedral

$\Rightarrow$ 5 unpaired electron

$\Rightarrow$ 5.9 B.M.

$[CoF_6]^{3-} \Rightarrow sp^3d^2$ hybridized, octahedral

$\Rightarrow$ 4 unpaired electron

$\Rightarrow$ 4.9 B.M.

52. $A \rightarrow D$ is an endothermic reaction occurring in three steps (elementary).

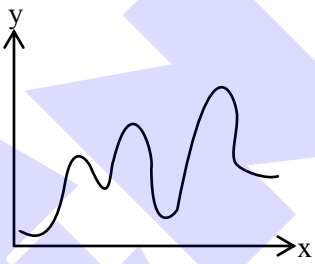
(i) $A \rightarrow B$ ΔH_i = +ve

(ii) $B \rightarrow C$ ΔH_{ii} = –ve

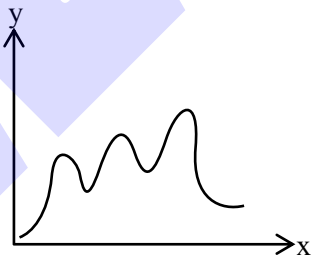
(iii) $C \rightarrow D$ ΔH_{iii} = –ve

Which of the following graphs between potential energy (y-axis) vs reaction coordinate (x-axis) correctly represents the reaction profile of $A \rightarrow D$?

(1)



(2)



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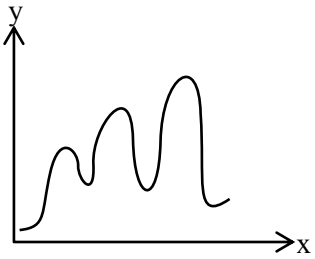
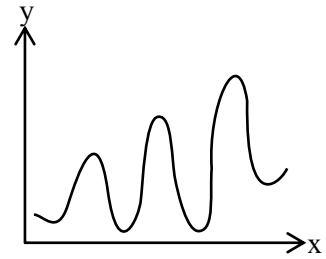


(4)



Ans. **(3)**

Sol. Given :

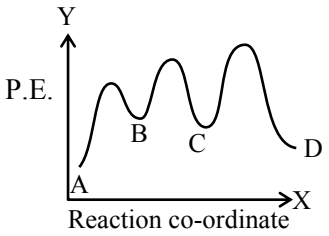
$A \rightarrow D$; $\Delta_r H = (+)ve = E_D - E_A$ $\therefore E_D > E_A$

Mechanism

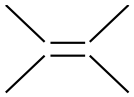
$A \rightarrow B$; $\Delta_r H = (+)ve \Rightarrow E_B > E_A$

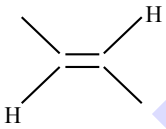
$B \rightarrow C$; $\Delta_r H = (-)ve \Rightarrow E_C < E_B$

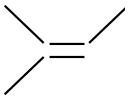
$C \rightarrow D$; $\Delta_r H = (-)ve \Rightarrow E_D < E_C$

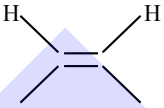


53. Arrange the following alkenes in decreasing order of stability.

I. 

II. 

III. 

IV. 

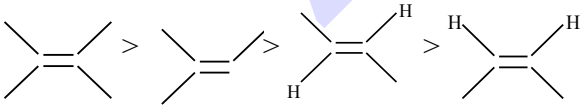
Choose the **correct** answer from the options given below :

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

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

Ans. **(3)**

Sol. Stability order :



αH = 12 αH = 9 αH = 6 αH = 6

trans cis

Trans is more stable than cis

54. Given below are statements about some molecules/ions.

Identify the **CORRECT** statements.

A. The dipole moment value of NF_3 is higher than that of NH_3.

B. The dipole moment value of BeH_2 is zero.

C. The bond order of O_2^{2-} and F_2 is same.

D. The formal charge on the central oxygen atom of ozone is –1.

E. In NO_2, all the three atoms satisfy the octet rule, hence it is very stable.

Choose the **correct** answer from the options given below :

(1) A, B, C, D & E (2) B & C only

(3) B, C & D only (4) A, C & D only

Ans. **(2)**

Sol. (A) Dipole moment : $NF_3 < NH_3$

(B) BeH_2 is 'sp' hybridized, linear molecule with zero dipole moment.

(C) $O_2^{-2} \Rightarrow$ bond order = 1

$F_2 \Rightarrow$ bond order = 1

(D) Formal charge on central oxygen atom in O_3 is +1.

(E) In NO_2; nitrogen does not follow octet rule.

55. A solution is prepared by dissolving 0.3 g of a non-volatile non-electrolyte solute 'A' of molar mass 60 g mol^{-1} and 0.9 g of a non-volatile non-electrolyte solute 'B' of molar mass 180 g mol^{-1} in 100 mL H_2O at 27°C. Osmotic pressure of the solution will be

[Given : R = 0.082 L atm K^{-1} mol^{-1}]

(1) 1.23 atm (2) 2.46 atm

(3) 0.82 atm (4) 1.47 atm

Ans. **(2)**

Sol. Mass of solute 'A' = 0.3 g

Moles of solute 'A' = $\frac{0.3\text{g}}{60\,\text{g/mol}} = \frac{1}{200}$ mol

Mass of solute 'B' = 0.9 g

Moles of solute 'B' $= \frac{0.9\,gm}{180\,g/mol} = \frac{1}{200}$ mol

Total molarity of all solutes

$= \frac{2/200}{100} \times 1000 = \frac{1}{10}$ M

$\therefore \pi = \frac{1}{10} \times 0.082 \times 300$

$\pi = 2.46$ atm.

56. Among the following, the CORRECT combinations are :

A. $IF_3 \rightarrow$ T-shaped (sp^3d)

B. $IF_5 \rightarrow$ Square pyramidal (sp^3d^2)

C. $IF_7 \rightarrow$ Pentagonal bipyramidal (sp^3d^3)

D. $ClO_4^- \rightarrow$ Square planar (sp^2d)

Choose the **correct** answer from the options given below :

(1) A, B and C only

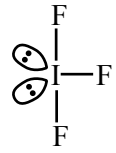
(2) A and B only

(3) A, B, C and D

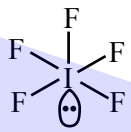
(4) B, C and D Only

Ans. (1)

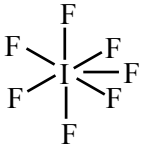
Sol.



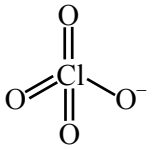
Hybridisation sp^3d (T-shape)



Hybridisation sp^3d^2 (Squar pyramidal)

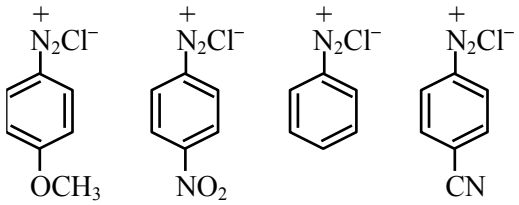


Hybridisation sp^3d^3 (Pentagonal bipyramidal)



Hybridisation sp^3 (Tetrahedral)

57. The correct stability order of the following diazonium salts is



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

(1) A > B > C > D (2) C > D > B > A

(3) A > C > D > B (4) C > A > D > B

Ans. (3)

Sol. Correct order of stability

A > C > D > B

+M –M –M

EDG increases stability

EWG decreases stability

58. Consider a mixture 'X' which is made by dissolving 0.4 mol of $[Co(NH_3)_5SO_4]$ Br and 0.4 mol of $[Co(NH_3)_5Br]SO_4$ in water to make 4 L of solution. When 2 L of mixture 'X' is allowed to react with excess of $AgNO_3$, it forms precipitate 'Y'. The rest 2 L of mixture 'X' reacts with excess $BaCl_2$ to form precipitate 'Z'. Which of the following statements is **CORRECT**.

(1) 0.2 mol of 'Z' is formed

(2) 'Y' is $BaSO_4$ and 'Z' is AgBr

(3) 0.4 mol of 'Z' is formed

(4) 0.1 mol of 'Y' is formed

Ans. (1)

Sol. 0.4 mol $[Co(NH_3)_5SO_4]Br$ + 0.4 mol $[Co(NH_3)_5$ Br] SO_4 are present in 4 lit. solution.

2 lit. of mixture will contain 0.2 mol of each complex.

2 lit. mixture on reaction with excess $AgNO_3$, 0.2 mole AgBr will be formed (Y).

2 lit. mixture on reaction with excess $BaCl_2$, 0.2 mole $BaSO_4$ will be formed (Z).

59. Given below are two statements

Statements-I : The number of paramagnetic species among $[CoF_6]^{3-}$, $[TiF_6]^{3-}$, V_2O_5 and $[Fe(CN)_6]^{3-}$ is 3.

Statement-II : $K_4[Fe(CN)_6] < K_3[Fe(CN)_6] < [Fe(H_2O)_6]\ SO_4.H_2O < [Fe(H_2O)_6]Cl_3$ is the correct order in terms of number of unpaired electron(s) in the complexes.

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

(1) Both statement-I and statement-II are true

(2) Both statement-I and statement-II are false

(3) Statement-I is true but statement-II is false

(4) Statement-I is false but statement-II is true

Ans. (1)

Sol. Paramagnetic species :

$[CoF_6]^{3-}$, $[TiF_6]^{3-}$, $[Fe(CN)_6]^{3-}$

Diamagnetic species : V_2O_5

In $K_4[Fe(CN)_6] \Rightarrow$ No. of unpaired electron = 0

$K_3[Fe(CN)_6] \Rightarrow$ No. of unpaired electron = 1

$[Fe(H_2O)_6]SO_4.H_2O \Rightarrow$ No. of unpaired electron = 4

$[Fe(H_2O)_6]Cl_3 \Rightarrow$ No. of unpaired electron = 5

60. Consider three metal chlorides x, y and z, where x is water soluble at room temperature, y is sparingly soluble in water at room temperature and z is soluble in hot water. x, y and z are respectively

(1) $MgCl_2$, AgCl and $AlCl_3$

(2) AgCl, Hg_2Cl_2 and $PbCl_2$

(3) $AlCl_3$, $PbCl_2$ and $BaCl_2$

(4) $CuCl_2$, AgCl and $PbCl_2$

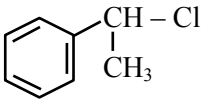
Ans. (4)

Sol. $MgCl_2$, $AlCl_3$, $CuCl_2$ are water soluble at room temperature.

AgCl, Hg_2Cl_2 are sparingly soluble in water

$PbCl_2$ is soluble in hot water.

61. Match the **List-I** with **List-II**

List-I (Chloro derivative)		**List-II (Example)**	
A.	Vinyl Chloride	I.	$CH_2 = CH - CH_2Cl$
B.	Benzyl chloride	II.	$CH_3 = CH(Cl)CH_3$
C.	Alkyl chloride	III.	$CH_2 = CHCl$
D.	Allyl chloride	IV.	

Choose the correct answer from the options given below :

(1) A-IV, B-I, C-III, D-II

(2) A-III, B-IV, C-I, D-II

(3) A-III, B-IV, C-II, D-I

(4) A-I, B-II, C-IV, D-III

Ans. (3)

Sol. Common Name (Theory based)

62. 'W' g of a non-volatile electrolyte solid solute of molar mass 'M' g mol^{-1} when dissolved in 100 mL water, decreases vapour pressure of water from 640 mm Hg to 600 mm Hg. If aqueous solution of the electrolyte boils at 375 K and K_b for water is 0.52 K kg mol^{-1}, then the mole fraction of the electrolyte solute (x_2) in the solution can be expressed as

(Given : density of water = 1 g/mL and boiling point of water = 373 K)

(1) $\frac{1.3}{8} \times \frac{W}{M}$ (2) $\frac{16}{2.6} \times \frac{W}{M}$

(3) $\frac{2.6}{16} \times \frac{M}{W}$ (4) $\frac{1.3}{8} \times \frac{M}{W}$

Ans. (1)

Sol. $P° = 640$ mm Hg

$P_s = 600$ mm Hg

$\Delta P = 40$ mm Hg

moles of solute = $\frac{W}{M}$

$\frac{\Delta P}{P^o} = i.X_{solute}$

Again :

$\Delta T_b = i \times k_b \times m$

$2 = i \times 0.52 \times \frac{W/M}{100} \times 1000$

$i = \frac{2}{5.2} \times \frac{M}{W}$

$X_{solute} = \frac{40}{640} \times \frac{1}{i} = \frac{1}{16} \times \frac{5.2}{2} \times \frac{W}{M}$

$X_{solute} = \frac{1.3}{8} \times \frac{W}{M}$

63. Match the List-I with List-II

List-I (Isothermal process for ideal gas system)		**List-II Work done ($V_f > V_i$)**	
A.	Reversible expansion	I.	$w = 0$
B.	Free expansion	II.	$w = -nRT \ln \frac{V_f}{V_i}$
C.	Irreversible expansion	III.	$w = -p_{ex}(V_f - V_i)$
D.	Irreversible compression	IV.	$w = -p_{ex}(V_i - V_f)$

Choose the **correct** answer from the options given below :

(1) A-IV, B-I, C-III, D-II

(2) A-IV, B-II, C-III, D-I

(3) A-I, B-III, C-II, D-IV

(4) A-II, B-I, C-III, D-IV

Ans. (4)

Sol. (A) $W_{Rev.} = -\int P_{gas}\, dV$

$W_{Rev.\ Isot.\ Exp.} = -nRT \ln \left[\frac{V_f}{V_i}\right]$

(A) $\rightarrow$ (II)

(B) Free expansion

$W_{irrev.} = -P_{ext}\, \Delta V$

$P_{ext} = 0$

$W = 0$

(B) $\rightarrow$ (I)

(C) Irreversible expansion

$W_{irrev.} = -P_{ext}\, \Delta V$

$W_{irrev.} = -P_{ext}(V_f - V_i)$

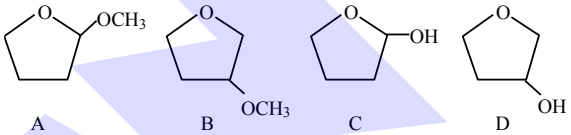
(C) $\rightarrow$ (III)

(D) Irreversible compression

$W_{irrev.} = -P_{ext}\, \Delta V$

$W_{irrev.} = -P_{ext}(V_i - V_f)$

64. A student is given one compound among the following compounds that gives positive test with Tollen's reagent.



A B C D

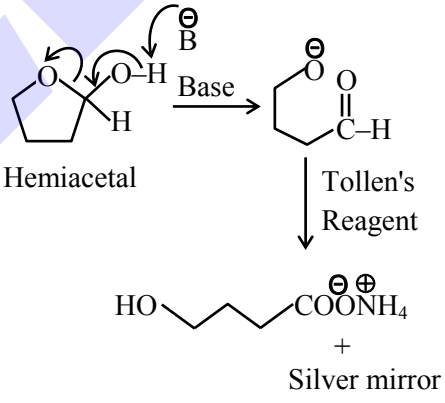
The compound is :

(1) D (2) A

(3) B (4) C

Ans. (4)

Sol.



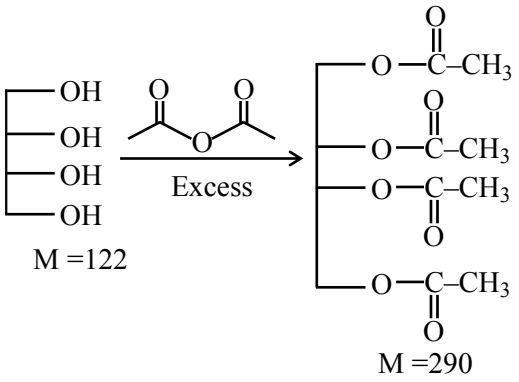
65. A hydroxy compound (X) with molar mass 122 g mol^{-1} is acetylated with acetic anhydride, using a large excess of the reagent ensuring complete acetylation of all hydroxyl groups. The product obtained has a molar mass of 290 g mol^{-1}. The number of hydroxyl groups present in compound (X) is :

(1) 3 (2) 5

(3) 2 (4) 4

Ans. (4)

Sol.



$$\text{No. of OH groups} = \frac{290-122}{42} = 4$$

66. At 27°C in presence of a catalyst, activation energy of a reaction is lowered by 10 kJ mol^{-1}. The logarithm ratio of $\frac{k(\text{catalysed})}{k(\text{uncatalysed})}$ is ....

(Consider that the frequency factor for both the reactions is same)

(1) 17.41

(2) 1.741

(3) 3.482

(4) 0.1741

Ans. (2)

Sol. $\frac{K_{catalyst}}{K_{uncatalyst}} = e^{\frac{\Delta E_a}{RT}}$

$$\ln\frac{K_{catalyst}}{K_{uncatalyst}} = \frac{\Delta E_a}{RT}$$

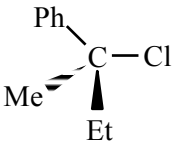
$$\log\frac{K_{catalyst}}{K_{uncatalyst}} = \frac{\Delta E_a}{2.303RT}$$

$$= \frac{10\times1000}{2.303\times8.314\times300}$$

$$\log\frac{K_{catalyst}}{K_{uncatalyst}} = 1.741$$

67. Given below are two statements :

Statement I : 'C–Cl' bond is stronger in $CH_2 = CH - Cl$ than $CH_3 - CH_2 - Cl$

Statement II : The given optically active molecule,  on hydrolysis gives a solution that can rotate the plane polarized light.

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

(1) Statement I is false but Statement II is true

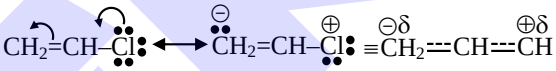
(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

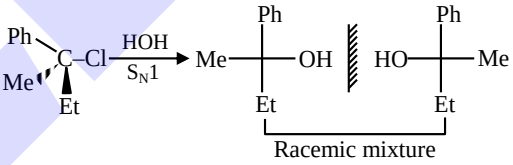
Ans. (4)

Sol. Statement-I :



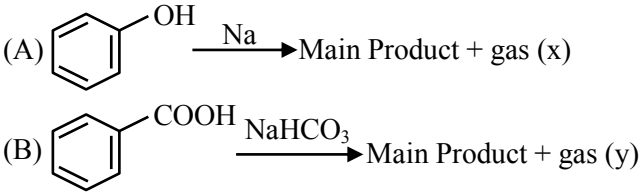
C–Cl bond is strong in vinyl chloride because of double bond character.

Statement-II :



Racemic mixture is optically inactive, which can not rotate PPL.

68. Consider the following two reactions A and B.



Numerical value of [molar mass of x+ molar mass of y] is ____ .

(1) 4 (2) 88

(3) 46 (4) 160

Ans. (3)

Sol. x = H_2 (gas), y = CO_2 (gas)

Sum of molar mass = 2 + 44 = 46

69. Arrange the following carbanions in the decreasing order of stability

I. $p-Br-C_6H_4-\overset{\ominus}{\underset{\bullet\bullet}{C}}H_2$

II. $C_6H_5-\overset{\ominus}{\underset{\bullet\bullet}{C}}H_2$

III. $p-CH_3O-C_6H_4-\overset{\ominus}{\underset{\bullet\bullet}{C}}H_2$

IV. $p-CHO-C_6H_4-\overset{\ominus}{\underset{\bullet\bullet}{C}}H_2$

V. $p-CH_3-C_6H_4-\overset{\ominus}{\underset{\bullet\bullet}{C}}H_2$

Choose the **correct** answer from the options given below :

(1) I > II > IV > V > III

(2) I > IV > II > V > III

(3) IV > I > II > V > III

(4) IV > II > I > III > V

Ans. **(3)**

Sol. Electron withdrawing groups increases stability of carbanion and electron donating groups decreases stability of carbanion.

70. Given below are two statements :

Statement I : K > Mg > Al > B is the correct order in terms of metallic character.

Statement II : Atomic radius is always greater than the ionic radius for any element.

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

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Statement I is false but Statement II is true

(4) Statement I is true but Statement II is false

Ans. **(4)**

Sol. Metallic character of s-block elements is greater than p-block elements.

Anionic radius is greater than atomic radius but cationic radius is always less than atomic radius for any element.

SECTION-B

71. Electricity is passed through an acidic solution of Cu^{2+} till all the cu^{2+} was exhausted, leading to the deposition of 300 mg of Cu metal. However, a current of 600 mA was continued to pass through the same solution for another 28 minutes by keeping the total volume of the solution fixed at 200 mL. The total volume of oxygen evolved at STP during the entire process is _____ mL. (Nearest integer)

[Given :

$Cu^{2+}(aq)+2e^- \rightarrow Cu(s)\ E^0_{red}=+0.34V$

$O_2(g)+4H^++4e^- \rightarrow 2H_2O\ E^0_{red}=+1.23V$

Molar mass of Cu = 63.54 g mol^{-1}

Molar mass of O_2 = 32 g mol^{-1}

Faraday Constant = 96500 C mol^{-1}

Molar volume at STP = 22.4 L]

Ans. **(111)**

Sol. Eq of Cu = Eq of O_2

$$\frac{300\times10^{-3}\times2}{63.54}=n_{O_2}\times4$$

$2.36\times10^{-3}=n_{O_2}$

When current is further passed

$$n_{O_2}\times4=\frac{600\times28\times60}{96500\times1000}$$

$n_{O_2}=2.611\times10^{-3}$

Total O_2 released

$=[10^{-3}\times(2.36+2.611)]\times22400$ ml

= 111.35 ml

72. Consider two Group IV metal ions X^{2+} and Y^{2+}.

A solution containing 0.01 MX^{2+} and 0.01 MY^{2+} is saturated with H_2S. The pH at which the metal sulphide YS will form as a precipitate is _____ (Nearest integer)

(Given :

$K_{sp}(XS)=1\times10^{-22}$ at 25°C, $K_{sp}(YS)=4\times10^{-16}$ at 25°C,

$[H_2S]$ = 0.1M in solution, $K_{a1}\times K_{a2}(H_2S)=1.0\times10^{-21}$,

log 2 = 0.30, log 3 = 0.48, log 5 = 0.70)

Ans. (4)

Sol. $XS(s) \rightleftharpoons X^{+2}(aq.) + S^{2-}(aq.)$

For precipitation of XS(s)

$[X^{+2}][S^{2-}] \geq K_{SP}(XS)$

$[S^{2-}] \geq \frac{1\times10^{-22}}{0.01} = 10^{-20}$

$YS(s) \rightleftharpoons Y^{+2}(aq) + S^{2-}(aq)$

For precipitation of YS(s)

$[Y^{+2}][S^{2-}] \geq K_{SP}(YS)$

$[S^{2-}] \geq \frac{4\times10^{-16}}{10^{-2}} = 4 \times 10^{-14}$

Now, $H_2S(aq) \rightleftharpoons 2H^+(aq) + S^{2-}(aq)$

$\frac{[S^{2-}][H^+]^2}{H_2S} = K_{a_1} \times K_{a_2} = 1\times10^{-21}$

$[S^{2-}] = \frac{1\times10^{-21}\times[H_2S]}{[H^+]^2} \geq 4 \times 10^{-14}$

$[H^+]^2 \leq \frac{1}{4} \times 10^{-7} \times 10^{-1}$

$[H^+] \leq \frac{1}{2} \times 10^{-4} \Rightarrow pH \geq 4.3$

73. The hydrogen spectrum consists of several spectral lines in Lyman series (L_1, L_2, L_3 ….; L_1 has lowest energy among Lyman series). Similarly it consists of several spectral lines in Balmer series (B_1, B_2, B_3……. ; B_1 has lowest energy among Balmer lines). The energy of L_1 is x times the energy of B_1. The value of x is _____ $\times 10^{-1}$ (Nearest inteter)

Ans. (54)

Sol. $\Delta E(L_1) = 13.6\times Z^2\left(\frac{1}{1^2} - \frac{1}{2^2}\right) = 13.6Z^2 \times \frac{3}{4}$

$\Delta E(B_1) = 13.6\times Z^2 \times \left(\frac{1}{2^2} - \frac{1}{3^2}\right) = 13.6\times Z^2 \times \frac{5}{4\times9}$

$\frac{\Delta E(L_1)}{\Delta E(B_1)} = \frac{3}{5}\times9 = \frac{27}{5} = x$

$x = \left(\frac{27}{5}\times10\right)\times10^{-1} = 54 \times 10^{-1}$

74. In Dumas method for estimation of nitrogen, 0.50 g of an organic compound gave 70 mL of nitrogen collected at 300 K and 715 mm pressure. The percentage of nitrogen in the organic compound is _____%

(Aqueous tension at 300 K is 15 mm).

Ans. (15)

Sol. $P_{N_2} = (715-15)mm = \frac{700}{760}atm$

$V_{N_2} = 70\,ml = \frac{70}{1000}l$

$n_{N_2} = \frac{PV}{RT} = \frac{\left(\frac{700}{760}\right)\times\left(\frac{70}{1000}\right)}{0.0821\times300}$

$W_{N_2} = \frac{700}{760}\times\frac{\frac{70}{1000}}{0.0821\times300}\times28$

$\%\,N = \frac{W_{N_2}}{0.5}\times100 = \frac{700}{760}\times\frac{70/1000}{0.0821\times300}\times\frac{28}{0.5}\times100$

$= 14.65\% \approx 15$

75. X and Y are the number of electrons involved, respectively during the oxidation of I^- to I_2 and S^{2-} to S by acidified $K_2Cr_2O_7$. The value of X + Y is _____.

Ans. (12)

Sol. $Cr_2O_7^{2-} + 14H^+ + 6I^- \rightarrow 2Cr^{3+} + 3I_2 + 7H_2O$

no. of moles e^- involved = x = 6

$Cr_2O_7^{2-} + 3S^{2-} + 14H^+ \rightarrow +S + 2Cr^{3+} + 7H_2O$

No. of moles e^- involved = y = 6

Sum of x + y = 6 + 6 = 12

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