JEE Main January 2026

Question Paper With Text Solution

21 January | Shift-1

CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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JEE MAIN JANUARY 2026 | 21 JANUARY SHIFT-1

SECTION – A

Question ID : 8606541193

51. An organic compound (P) on treatment with aqueous ammonia under hot condition forms compound (Q) which on heating with Br_2 and KOH forms compound (R) having molecular formula C_6H_7N. Names of P, Q and R respectively are.

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(1) Benzoic acid, benzamide, aniline

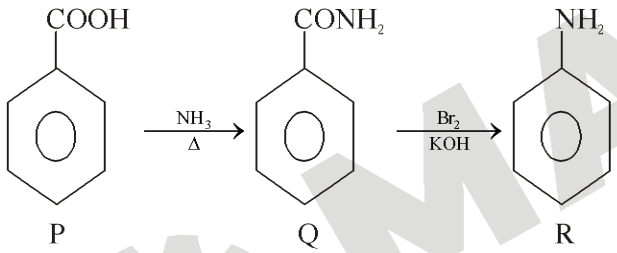
(2) Toluic acid, methylbenzamide, 2-methylaniline

(3) Phenylethanoic acid, phenylethanamide, benzamine

(4) Benzoic acid, 4-methylbenzamide, 4-methylaniline

Ans. Official answer NTA (1)

Sol.



Question ID : 8606541194

52. Identify the correct statements.

A. Arginine and Tryptophan are essential amino acids.

B. Histidine does not contain heterocyclic ring in its structure.

C. Proline is a six membered cyclic ring amino acid.

D. Glycine does not have chiral centre.

E. Cysteine has characteristic feature of side chain as $MeS - CH_2 - CH_2 -$.

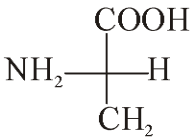
Choose the correct answer from the options given below :

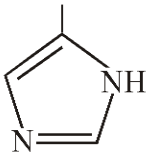
क

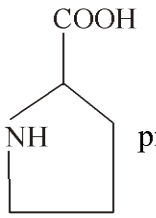
(1) B and E Only (2) A and D Only (3) C and D Only (4) C and E Only

Ans. Official answer NTA (2)

Sol. (A) Arginine and Tryptophan are essential amino acids.

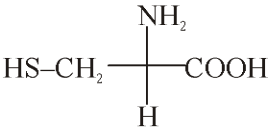


(B)  Histidine has heterocyclic ring in its structure.



(C) proline is a 5 numbered cyclic ring amino acid.

(D) $NH_2–CH_2–COOH$ glycine does not have chiral centre.



(E) is structure of cysteine.

Question ID : 8606541189

53. Identify correct statements from the following :

A. Propanal and propanone are functional isomers.

B. Ethoxyethane and methoxypropane are metamers.

C. But-2-ene shows optical isomerism.

D. But-1-ene and but-2-ene are functional isomers.

E. Pentane and 2, 2-dimethyl propane are chain isomers.

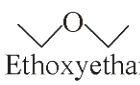
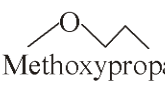
Choose the correct answer from the options given below :

क

(1) B, C and D only (2) C, D and E only (3) A, B and C only (4) A, B and E only

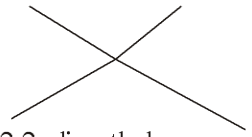
Ans. Official answer NTA (4)

Sol. (A) $CH_3–CH_2–CHO$ (Propanal) and $CH_3–\overset{\overset{O}{\|}}{C}–CH_3$ (Propanone) are functional isomers.

(B)   are metamers.

(C) $CH_3–CH=CH–CH_3$ does not show optical isomerism.

(D) But–1–ene and But–2–ene are position isomers.

(E)  and  are chain isomers.

2,2–dimethyl propane

Question ID : 8606541176

54. 80 mL of a hydrocarbon on mixing with 264 mL of oxygen in a closed U-tube undergoes complete combustion. The residual gases after cooling to 273 K occupy 224 mL . When the system is treated with KOH solution, the volume decreases to 64 mL . The formula of the hydrocarbon is :

क

(1) C_4H_{10} (2) C_2H_4 (3) C_2H_6 (4) C_2H_2

Ans. Official answer NTA (4)

Sol. $C_xH_y(g)+\left(x+\frac{y}{4}\right)O_2(g)\longrightarrow xCO_2(g)+\frac{y}{2}H_2O(\ell)$

80 264

$264-80\left(x+\frac{y}{4}\right)$ $80x$

$264-80\left(x+\frac{y}{4}\right)+80x=224$

$40=80\times\frac{y}{4}$

y = 2

224 – 80x = 64

x = 2

C_2H_2

Question ID : 8606541182

55. Elements P and Q form two types of non-volatile, non-ionizable compounds PQ and PQ_2. When 1 g of PQ is dissolved in 50 g of solvent 'A', ΔT_b was 1.176 K while when 1 g of PQ_2 is dissolved in 50 g of solvent 'A', ΔT_b was 0.689 K . (K_b of 'A' =5 K kg mol^{-1}). The molar masses of elements P and Q (in g mol^{-1}) respectively, are :

क

(1) 70,110 (2) 25, 60 (3) 60, 25 (4) 65, 145

Ans. Official answer NTA (2)

Sol. $\Delta T_b = 1.176 = K_b m$

$$1.176 = 5 \times \frac{\frac{1}{(P+Q)}}{\frac{50}{1000}}$$

$$0.689 = \frac{5 \times \frac{1}{(P+2Q)}}{\frac{50}{1000}}$$

$P + Q = 85$ $\quad$ $P + 2Q = 145$

$Q = 60$ $\quad$ $P = 25$

Question ID : 8606541186

56. Given below are two statements :

Statement I: Among $[Cu(NH_3)_4]^{2+}$, $[Ni(en)_3)]^{2+}$, $[Ni\ (NH_3)_6]^{2+}$ and $[Mn(H_2O)_6]^{2+}$, $[Mn(H_2O)_6]^{2+}$ has the maximum number of unpaired electrons.

Statement II : The number of pairs among $\{[NiCl_4]^{2-}, [Ni(CO)_4]\}$, $\{[NiCl_4]^{2-}, [Ni(CN)_4]^{2-}\}$ and $\{[Ni(CO)_4], [Ni(CN)_4]^{2-}\}$ that contain only diamagnetic species is two.

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

क

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

(2) Both Statement I and Statement II are false

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

(4) Both Statement I and Statement II are true

Ans. Official answer NTA (1)

Sol.

$[Cu(NH_3)_4]^{2+}$	$3d^9 4s^0$	1 unpaired e^-	(dsp^2)
$[Ni(en)_3]^{2+}$	$3d^8 4s^0$	2 unpaired e^-	(sp^3d^2)
$[Ni(NH_3)_6]^{2+}$	$3d^8 4s^0$	2 unpaired e^-	(sp^3d^2)
$[Mn(H_2O)_6]^{2+}$	$3d^5 4s^0$	5 unpaired e^-	(sp^3d^2)

Statement I is true.

$[NiCl_4]^{2-}$	$3d^8 4s^0$	paramagnetic	(sp^3)
$[Ni(CO)_4]$	$3d^{10} 4s^0$	diamagnetic	(sp^3)
$[Ni(CN)_4]^{2-}$	$3d^8 4s^0$	diamagnetic	(dsp^2)

Only 1 pair contain diamagnetic specie.

Statement II is false.

Question ID : 8606541179

57. Given below are two statements :

Statement I: When an electric discharge is passed through gaseous hydrogen, the hydrogen molecules dissociate and the energetically excited hydrogen atoms produce electromagnetic radiation of discrete frequencies.

Statement II: The frequency of second line of Balmer series obtained from He^+ is equal to that of first line of Lyman series obtained from hydrogen atom."In the light of the above statements, choose the correct answer from the options given below :

क

(1) Both Statement I and Statement II are false

(2) Both Statement I and Statement II are true

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

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

Ans. Official answer NTA (2)

Sol. In presence of energy H_2 molecules dissociate and excited e^-s deexcite to produce electromagnetic radiation of discrete frequencies.

Statement I is true.

For He^{+1} second line of Balmer series

$$\frac{1}{\lambda} = R\left(\frac{1}{2^2} - \frac{1}{4^2}\right)2^2$$

$$= R\left(1 - \frac{1}{4}\right)$$

$$\lambda = \frac{4}{3R}$$

For H first line of Lymann series

$$\frac{1}{\lambda} = R\left(\frac{1}{1^2} - \frac{1}{2^2}\right)$$

$$\lambda = \frac{4}{3R}$$

Both λ are equal so frequency is also equal.

Question ID : 8606541178

58. Given below are two statements :

Statement I : The number of species among SF_4, NH_4^+, $[NiCl_4]^{2-}$, XeF_4, $[PtCl_4]^{2-}$, SeF_4 and $[Ni(CN)_4]^{2-}$, that have tetrahedral geometry is 3 .

Statement II : In the set [NO_2, BeH_2, BF_3, $AlCl_3$], all the molecules have incomplete octet around central atom.

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

क

(1) Both Statement I and Statement II are true

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

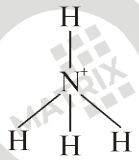
(3) Both Statement I and Statement II are false

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

Ans. Official answer NTA (2)

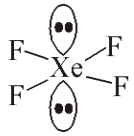
Sol. SF_4  sp^3d $[PtCl_4]^{2-}$ $5d^84s^0$

dsp^2

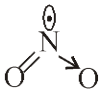
NH_4^+  sp^3 SeF_4 like SF_4 sp^3d

$[NiCl_4]^{2-}$ $3d^84s^0$ sp^3 $[Ni(CN)_4]^{2-}$ $3d^84s^0$

dsp^2

XeF_4  sp^3d^2

Statement I is false.

 H–Be–H  

all have incomplete octet.

Statement II is true.

Question ID : 8606541191

59. Identify A in the following reaction.

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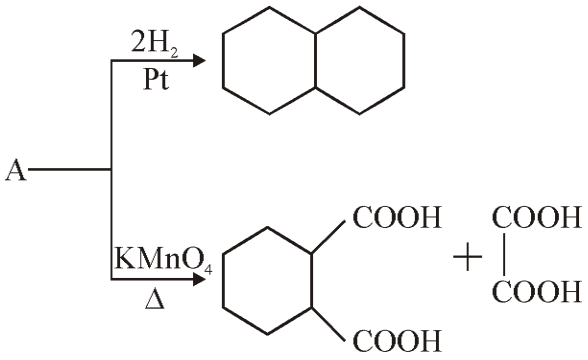
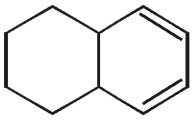
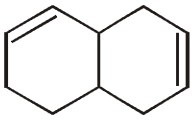
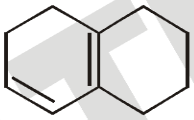
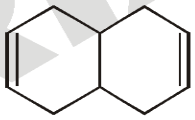
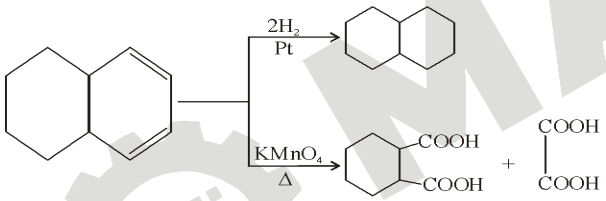


(1) 
(2) 
(3) 
(4) 

Ans. Official answer NTA (1)

Sol. 

Question ID : 8606541177

60. 14.0 g of calcium metal is allowed to react with excess HCl at 1.0 atm pressure and 273 K .

Which of the following statements is incorrect?

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(1) The limiting reagent is calcium metal.
(2) 7.84 L of H_2 gas is evolved.
(3) 0.35 mol of H_2 gas is evolved.
(4) 33.3 g of $CaCl_2$ is produced.

Ans. Official answer NTA (4)

Sol. $Ca + 2HCl \rightarrow CaCl_2 + H_2$

0.35moles excess

– Left 0.35 0.35

7.84 L of H_2 gas is produced.

38.85 g of $CaCl_2$ is produced.

Question ID : 8606541192

61. An organic compound "P" of molecular formula $C_6H_{12}O_3$ gives positive Iodoform test but negative Tollen's test. When "P" is treated with dilute acid, it produces "Q". "Q" gives positive Tollen's test and also iodoform test. The structure of "P" is :

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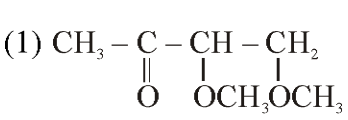
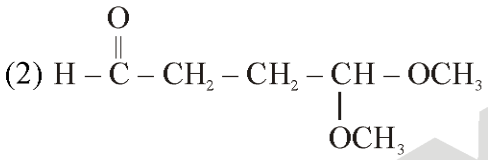
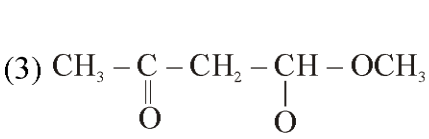
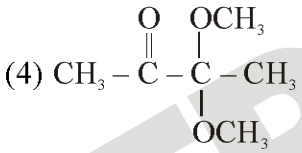
(1) 

(2) 

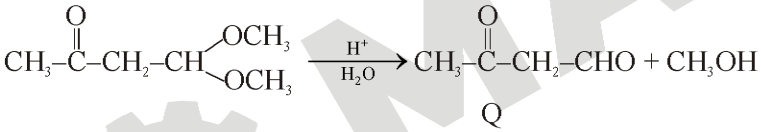
(3) 

(4) 

Ans. Official answer NTA (3)

Sol. P $C_6H_{12}O_3$ gives +ve iodoform test so methyl ketone

–ve tollens test so it is not aldehyde.



Q has methyl ketone as well as aldehyde.

Question ID : 8606541181

62. Which of the following graphs between pressure 'p' versus volume 'V' represents the maximum work done ?

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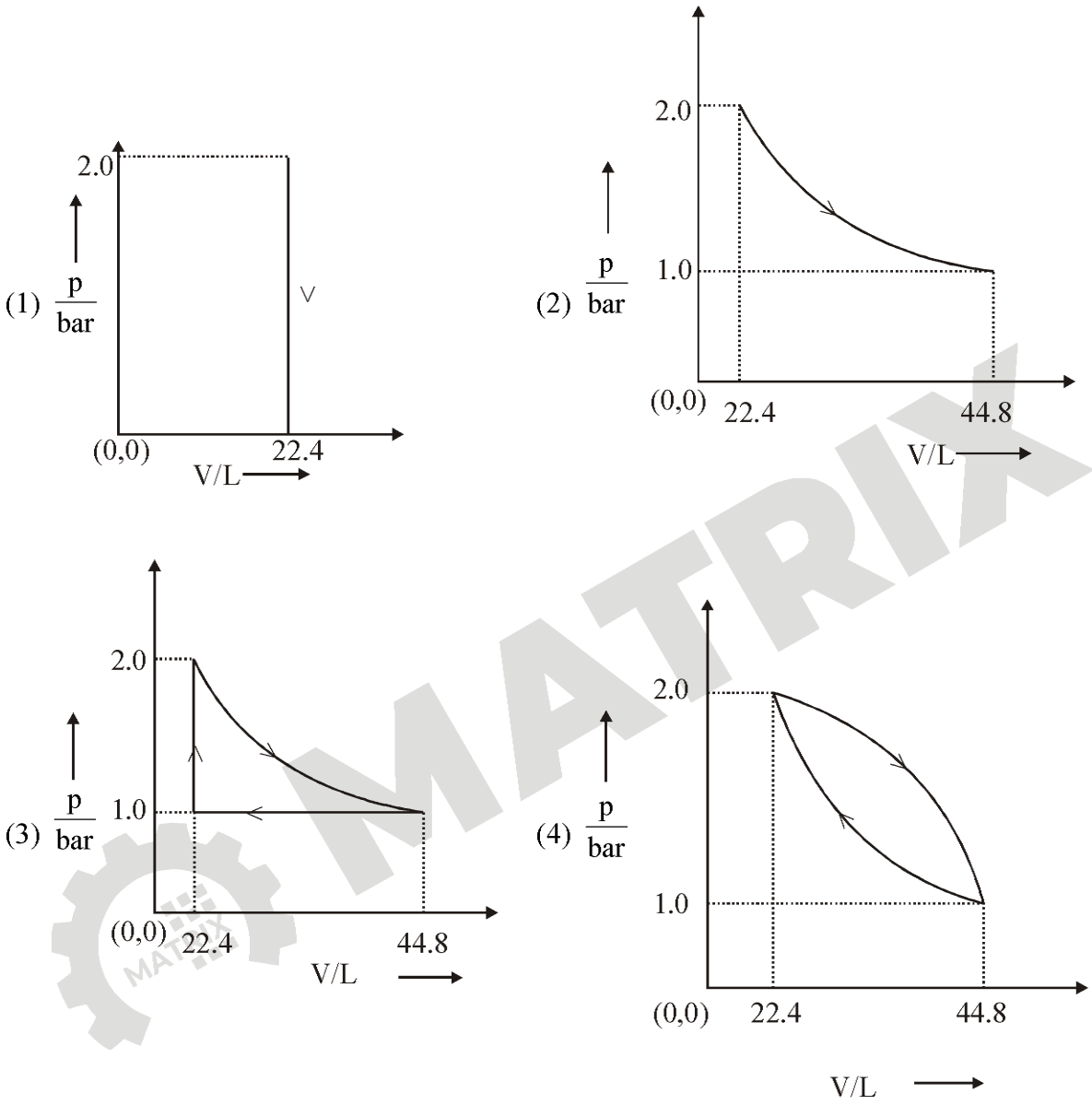

Ans. Official answer NTA (2)

Answer by MATRIX (1)

Sol. Answer given by NTA is based on magnitude of work done but considering the sign of work done the maximum work will be = 0

hence the correct option shoud be (1)

Area under the P v/s V curve, is equal to magnitude of work. In option (2) work done is zero while in remaining options net work done is negative due to expansion.

Question ID : 8606541188

63. From the following, the least stable structure is :

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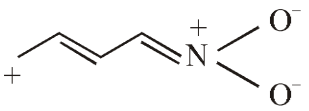
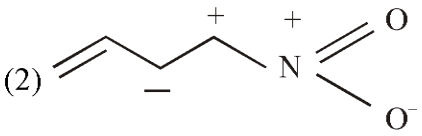
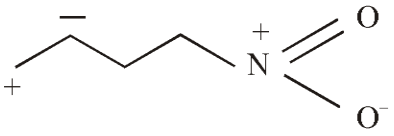
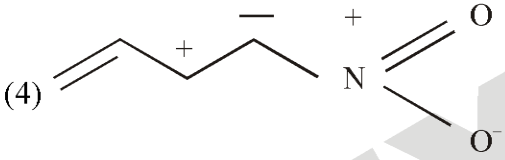
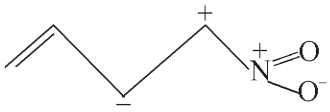
(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (2)

Sol.  has like charges close to each other so they repel each other.

Question ID : 8606541190

64. A hydrocarbon 'P' (C_4H_8) on reaction with HCL gives an optically active compound 'Q' (C_4H_9Cl) which on reaction with one mole of ammonia gives compound 'R' ($C_4H_{11}N$). 'R' on diazotization followed by hydrolysis gives 'S'. Identify P, Q, R and S.

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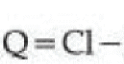
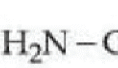
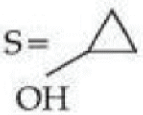
(1) $P = CH_3 - CH = CH - CH_3$, $Q = CH_3 - CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH}} - CH_3$, $R = CH_3 - CH_2 - \underset{\displaystyle NH_2}{\underset{|}{CH}} - CH_3$, $S = CH_3 - CH_2 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

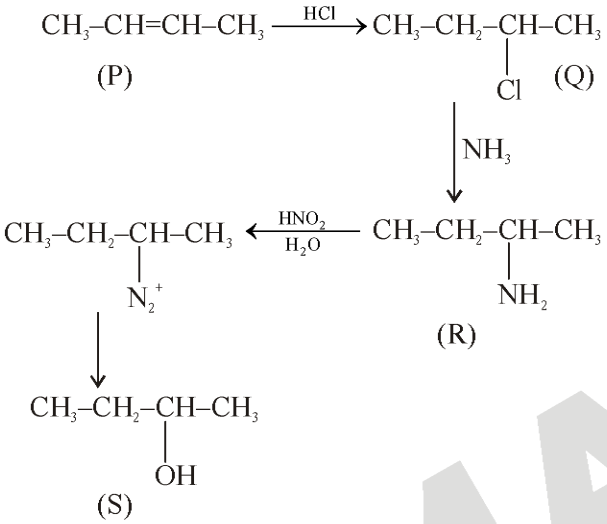
(2) $P = CH_3 - CH_2 - CH = CH_2$, $Q = CH_3 - CH_2 - CH_2 - \underset{\displaystyle Cl}{\underset{|}{CH_2}}$, $R = CH_3 - CH_2 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{NH}}$, $S = CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle OH}{\overset{|}{CH}}}}$

(3) $P = CH_3$  , $Q = Cl - CH_2$  , $R = H_2N - CH_2$  , $S =$ 

(4) P = $CH_3-CH=CH-CH_3$, Q = $CH_3-CH_2-CH_2-CH_2-Cl$, R = $CH_3-CH_2-CH_2-\underset{\displaystyle NH_2}{\underset{|}{CH_2}}$, S = $CH_3-CH_2-\underset{\displaystyle CH_2\\ \displaystyle OH}{\underset{|}{CH_2}}$

Ans. Official answer NTA (1)

Sol.



Question ID : 8606541195

65. Consider the following reactions.

$PbCl_2 + K_2CrO_4 \rightarrow A + 2KCl$

(Hot solution)

$A + NaOH \rightleftharpoons B + NaCrO_4$

$PbSO_4 + 4CH_3COONH_4 \rightarrow (NH_4)_2SO_4 + X$

In the above reactions, A, B and X are respectively.

क

(1) $Na_2[Pb(OH)_2]$, $PbCrO_4$ and $(NH_4)_2[Pb(CH_3COO)_4]$

(2) $Na_2[Pb(OH)_2]$, $PbCrO_4$ and $[Pb(NH_3)_4]\,SO_4$

(3) $PbCrO_4$, $Na_2[Pb(OH)_4]$ and $[Pb(NH_3)_4]\,SO_4$

(4) $PbCrO_4$, $Na_2[Pb(OH)_4]$ and $(NH_4)_2[Pb(CH_3COO)_4]$

Ans. Official answer NTA (4)

Sol. $PbCl_2 + K_2CrO_4 \rightarrow PbCrO_4 + 2KCl$

$PbCrO_4 + 4NaOH \rightleftharpoons Na_2\left(Pb(OH)_4\right) + Na_2CrO_4$

$PbSO_4 + 4CH_3COONH_4 \rightarrow (NH_4)_2SO_4 + (NH_4)_2\,[Pb(CH_3COO)_4]$

Question ID : 8606541184

66. Given below are two statements :

Statement I: The number of pairs among [SiO_2, CO_2], [SnO, SnO_2], [PbO, PbO_2] and [GeO, GeO_2], which contain oxides that are both amphoteric is 2 .

Statement II: BF_3 is an electron deficient molecule, can act as a Lewis acid, forms adduct with NH_3 and has a trigonal planar geometry.

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

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(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. Official answer NTA (1)

Sol. SiO_2 Acidic
CO_2 Acidic
PbO, PbO_2] Amphoteric

SnO, SnO_2] Amphoteric
GeO, GeO_2] Acidic

Statement I is correct.
BF_3 is Lewis acid so with NH_3 it forms adduct.
[$BF_3 \leftarrow NH_3$]
Statement II is correct.

Question ID : 8606541185

67. MnO_4^{2-}, in acidic medium, disproportionates to :

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(1) Mn_2O_7 and MnO

(2) MnO_4^- and MnO_2

(3) MnO_4^- and MnO

(4) Mn_2O_7 and MnO_2

Ans. Official answer NTA (2)

Sol. $MnO_4^{2-} \xrightarrow{\text{acidic}} MnO_4^- + MnO_2$

Question ID : 8606541187

68. In Carius method, 0.75 g of an organic compound gave 1.2 g of barium sulphate, find percentage of sulphur (molar mass 32 g mol^{-1}). Molar mass of barium sulphate is 233 g mol^{-1}.

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(1) 10.30 %

(2) 16.48 %

(3) 4.55 %

(4) 21.97 %

Ans. Official answer NTA (4)

Sol. $n_S = n_{BaSO_4}$

$= \frac{1.2}{233}$

mass of $S = \frac{1.2}{233} \times 32 = 0.16g$

$\%S = \frac{0.16}{0.75} \times 100 = 21.97\%$

Question ID : 8606541180

69. For the reaction, $N_2O_4 \rightleftharpoons 2NO_2$, graph is plotted as shown below. Identify correct statements.

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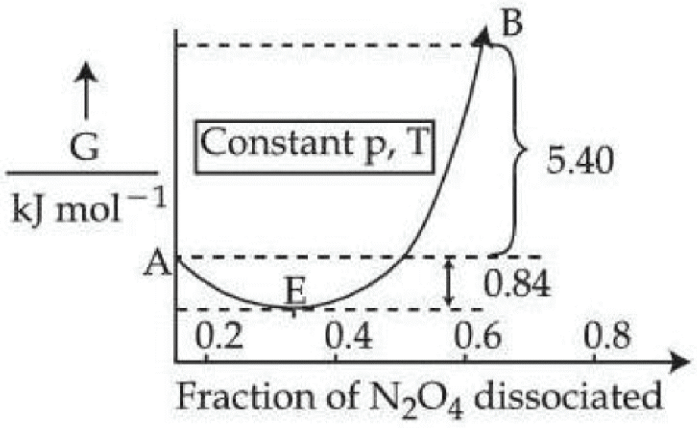
A. Standard free energy change for the reaction is –5.40 kJ mol^{-1}.

B. As ΔG° in graph is positive, N_2O_4 will not dissociate into NO_2 at all.

C. Reverse reaction will go to completion.

D. When 1 mole of N_2O_4 changes into equilibrium mixture, value of ΔG° = – 0.84 kJ mol^{-1}

E. When 2 mole of NO_2 changes into equilibrium mixture, ΔG° for equilibrium mixture is –6.24 kJ mol^{-1}



Choose the correct answer from the options given below :

(1) D and E only (2) C and E only (3) B and C only (4) A and D only

Ans. Official answer NTA (1)

Sol. $N_2O_4 \rightleftharpoons 2NO_2$

(A) $\Delta G^o = \Sigma G^o_{(P)} - \Delta G^o_{(R)}$

$= G_B - G_A = +ve$

(B) as ΔG^o is +ve so N_2O_4 will dissociate into NO_2 partially.

(C) Since forward reaction happen partially so backward reaction will not happen completely.

(D) When 1 mole of N_2O_4 changes into equilibrium mixture change of G is 0.84 w.r.t. initial.

$\Delta G^o = -0.84$ kJ/mol

(E) When 2 mole of NO_2 changes into equilibrium mixture change of G is (5.4 + 0.84) w.r.t. initial.

$\Delta G^o = -(0.84 + 5.4)$

$= -6.24$ kJ/mol

Question ID : 8606541183

70. Which of the following represents the correct trend for the mentioned property?

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A. F > P > S > B – First Ionization Energy

B. Cl > F > S > P – Electron Affinity

C. K > Al > Mg > B – Metallic character

D. $K_2O > Na_2O > MgO > Al_2O_3$ – Basic character

Choose the correct answer from the options given below :

(1) A and B only (2) A, B and D only (3) A, B, C and D (4) B and C only

Ans. Official answer NTA (2)

Sol. F > P > S > B Ionization energy

Cl > F > S > P electron affinity

K > Mg > Al > B Metallic character

$K_2O > Na_2O > MgO > Al_2O_3$ Basic character

A, B and D are correct.

SECTION – B

Question ID : 8606541200

71. Pre-exponential factors of two different reactions of same order are identical. Let activation energy of first reaction exceeds the activation energy of second reaction by 20 kJ mol^{-1}. If k_1 and k_2 are the rate constants of first and second reaction respectively at 300 K , then $\ln\frac{k_2}{k_1}$ will be _____. (nearest integer) [R = 8.3 J K^{-1} mol^{-1}]

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Ans. Official answer NTA (8)

Sol. For reaction (1) A = A of reaction (2)

$Ea_1 - Ea_2 = 20$ KJmol^{-1}

$$\frac{K_2}{K_1} = \frac{Ae^{-\frac{Ea_2}{RT}}}{Ae^{-\frac{Ea_1}{RT}}}$$

$$\frac{K_2}{K_1} = e^{\frac{Ea_1 - Ea_2}{RT}}$$

$$\frac{K_2}{K_1} = e^{\frac{20\times10^3}{R\times300}}$$

$$\ell n\frac{K_2}{K_1} = \frac{20\times10^3}{8.3\times300}$$

$= 8.03$

Question ID : 8606541198

72. Use the following data :

Substance	$\frac{\Delta_f H^{\ominus}(500K)}{kJ\ mol^{-1}}$	$\frac{S^{\ominus}(500K)}{J\ K^{-1}\ mol^{-1}}$
AB(g)	32	222
$A_2(g)$	6	146
$B_2(g)$	x	280

One mole each of $A_2(g)$ and $B_2(g)$ are taken in a 1 L closed flask and allowed to establish the equilibrium at 500 K .

$A_2(g) + B_2(g) \rightleftharpoons 2\ AB(g)$

The value of x (in $kJ\ mol^{-1}$) is _____ . (Nearest integer)

(Given : log K = 2.2 R = 8.3 $J\ K^{-1}\ mol^{-1}$)

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Ans. Official answer NTA (70)

Sol. log K = 2.2

$\Delta H^{\circ} = \Sigma\Delta H_{f(P)} - \Sigma\Delta H_{f(R)}$

$= [2(32) - (6 + x)] \times 10^3$ J

$\Delta S^{\circ} = \Sigma S_{(P)} - \Sigma S_{(R)}$

$= 2 \times 222 - (146 + 180)$

$= 18$

$\Delta G^{\circ} = -RT\ln K$

$= -8.3 \times 500 \times 2.303 \times \log K$

$= -21026.4$ J

$\Delta G^{\circ} = -21.02$ kJ

$\Delta G^{\circ} = \Delta H^{\circ} - T\Delta S^{\circ}$

$$-21.02 = (58 - x) - 500\left(\frac{18}{1000}\right)$$

$-21.02 = 58 - x - 9$

$-12.02 = 58 - x$

$x = 70.02$ kJ/mol

Question ID : 8606541199

73. The pH and conductance of a weak acid (HX) was found to be 5 and 4×10^{-5} S, respectively. The conductance was measured under standard condition using a cell where the electrode plates having a surface area of 1 cm^2 were at a distance of 15 cm apart. The value of the limiting molar conductivity is _____ S m^2 mol^{-1}. (nearest integer)

(Given : degree of dissociation of the weak acid (α) << 1)

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Ans. Official answer NTA (6)

matrix (5)

Sol. pH = 5 $\quad HX \rightleftharpoons H^+ + X^-$

$[H^+] = 10^{-5} = c\alpha \quad C$

$10^{-5} = c\frac{\lambda_m}{\lambda_m^\infty}$ ...(1) $\quad C - C\alpha \;\; C\alpha \quad C\alpha$

K = G.G*

$= 4\times10^{-5} \times \frac{15}{1} = 6 \times 10^{-4}$ s cm^{-1}

$\lambda_m = \frac{K\times1000}{C}$ ...(2)

Put (2) into (1)

$10^{-5} = C \times \frac{K\times1000}{\lambda_m^\infty \times C}$

$\lambda_m^\infty = 60 \times 10^3$ s cm^2 mol^{-1}

$= 6$ s m^2 mol^{-1}

Question ID : 8606541197

74. Consider the following reactions :

$NaCl + K_2Cr_2O_7 + H_2SO_4 \rightarrow A + KHSO_4 + NaHSO_4 + H_2O$

$A + NaOH \rightarrow B + NaCl + H_2O$

$B + H_2SO_4 + H_2O_2 \rightarrow C + Na_2SO_4 + H_2O$

In the product 'C', 'X' is the number of O_2^{2-} units, 'Y' is the total number oxygen atoms present and 'Z' is the oxidation state of Cr. The value of X + Y + Z is _____ .

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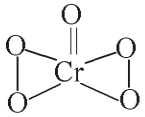
Ans. Official answer NTA (13)

Sol. $4NaCl + K_2Cr_2O_7 + H_2SO_4 \rightarrow 2CrO_2Cl_2 + 4NaHSO_4 + 2KHSO_4 + 3H_2O$

$CrO_2Cl_2 + 4NaOH \rightarrow Na_2CrO_4 + 2NaCl + 2H_2O$

$Na_2CrO_4 + 2H_2SO_4 + 2H_2O_2 \rightarrow CrO_5 + 2NaHSO_4 + 3H_2O$

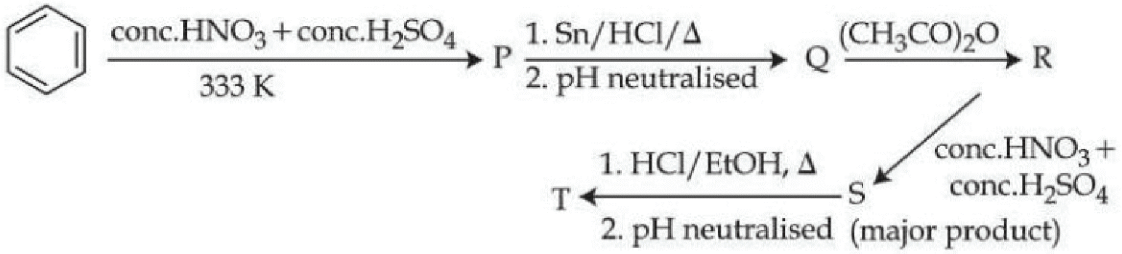
(C)

x = 2  y = 5

z = 6

Question ID : 8606541196

75. Consider the following reaction sequence :



The percentage of nitrogen in product 'T' formed is _____%. (Nearest integer)

(Given molar mass in g mol^{-1} H : 1, C : 12, N : 14, O : 16)

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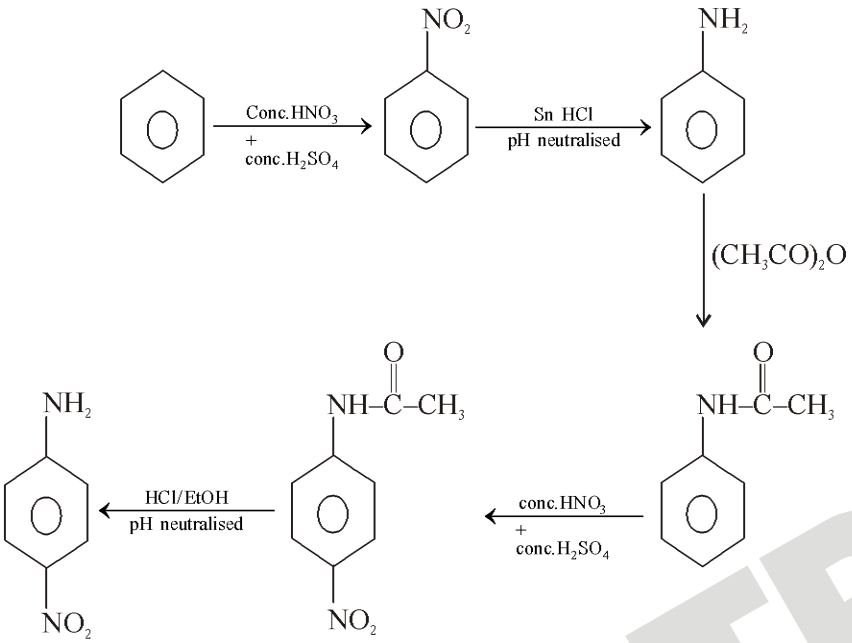
Ans. Official answer NTA (20)

Sol.



$$\%\,N = \frac{28}{138} \times 100$$

$$= 20.2$$