JEE Main January 2026

Question Paper With Text Solution

22 January | Shift-1

CHEMISTRY

MATRIX

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

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JEE MAIN JANUARY 2026 | 28 JANUARY SHIFT-2

SECTION – A

Question ID : 444792202

51. The energy required by electrons, present in the first Bohr orbit of hydrogen atom to be excited to second Bohr orbit is _____ J mol^{-1}.

Given $R_H = 2.18 \times 10^{-11}$ ergs.

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(1) 1.635×10^{-11} (2) 9.835×10^{12} (3) 9.835×10^{5} (4) 1.635×10^{-18}

Ans. Official answer NTA (3)

Sol. $\Delta E_{1\to 2} = E_2 - E_1$

$= 2.18\times10^{-18}\left(\frac{1}{1}-\frac{1}{4}\right)$

$= 2.18\times10^{-18}\times\frac{3}{4}\text{J/mol}$

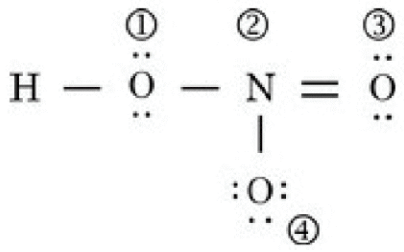
$= 1.635\times10^{-18}\text{ J/atom}$

$= 1.635\times10^{-18}\times6.02\times10^{23}\text{ J/mol}$

$= 9.835\times10^{5}\text{ J/mol}$

Question ID : 444792203

52. The formal charges on the atoms marked as (1) to (4) in the Lewis representation of HNO_3 molecule respectively are



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(1) 0, –1, 0, +1 (2) +1, 0, 0, –1 (3) 0, +1, 0, –1 (4) 0, 0, –1, +1

Ans. Official answer NTA (3)

Sol. Formal charge = valence e^- – (non bonding e^-) $-\left(\frac{\text{Bonding } e^-}{2}\right)$

(1) O

(2) +1

(3) O

(4) –1

Question ID : 444792208

53. A $\rightarrow$ product (First order reaction).

Three sets of experiment were performed for a reaction under similar experimental conditions :

Run 1 $\Rightarrow$ 100 mL of 10 M solution of reactant A

Run 2 $\Rightarrow$ 200 mL of 10 M solution of reactant A

Run 3 $\Rightarrow$ 100 mL of 10 M solution of reactant A + 100 mL of H_2O added.

The correct variation of rate of reaction is :

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(1) Run 1 = Run 2 = Run 3

(2) Run 3 < Run 1 < Run 2

(3) Run 3 < Run 1 = Run 2

(4) Run 1 < Run 2 < Run 3

Ans. Official answer NTA (3)

Sol. Rate = K[A]

Run (1) [A] = 10

Run (2) [A] = 10

Run (3) [A] = 5

[A) $\uparrow \rightarrow$ rate $\uparrow$

$\Rightarrow$ run(1) = Run(2) > run(3)

Question ID : 444792212

54. Consider the transition metal ions Mn^{3+}, Cr^{3+}, Fe^{3+} and Co^{3+} and all form low spin octahedral complexes. The correct decreasing order of unpaired electrons in their respective d-orbitals of the complexes is :

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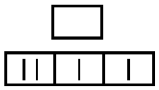
(1) $Cr^{3+} > Mn^{3+} > Fe^{3+} > Co^{3+}$

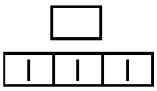
(2) $Mn^{3+} > Fe^{3+} > Co^{3+} > Cr^{3+}$

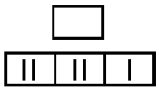
(3) $Fe^{3+} > Co^{3+} > Mn^{3+} > Cr^{3+}$

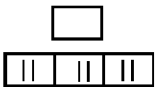
(4) $Cr^{3+} > Fe^{3+} > Co^{3+} > Mn^{3+}$

Ans. Official answer NTA (1)

Sol. $Mn^{3+} - 3d^4$  n = 2

$Cr^{3+} - 3d^3$  n = 3

$Fe^{3+} - 3d^5$  n = 1

$Co^{3+} - 3d^6$  n = 0

$Cr^{3+} > Mn^{3+} > Fe^{3+} > Co^{3+}$

Question ID : 444792207

55. A 'p'-block element (E) and hydrogen form a binary cation $(EH_x)^+$, while EH_3 on treatment with K_2HgI_4 in alkaline medium gives a precipitate of basic mercury(II)amido-iodine. Given below are first ionisation enthalpy values (kJ mol^{-1}) for first element each from group 13, 14, 15 and 16. Identify the correct first ionisation enthalpy value for element E .

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(1) 1402 (2) 801 (3) 1312 (4) 1086

Ans. Official answer NTA (1)

Sol. Element E is N, Binary cation is NH_4^+

$$NH_3 + H^+ \rightarrow NH_4^+$$

$$NH_3 + K_2HgI_4 + OH^- \rightarrow HgO.Hg(NH_2)I\downarrow$$

	13	14	15	16
I^{st} I.E	B	< C	< N	> O
	801	1086	1402	1312

Question ID : 444792217

56. As compared with chlorocyclohexane, which of the following statements correctly apply to chlorobenzene?

A. The magnitude of negative charge is more on chlorine atom.

B. The C – Cl bond has partial double bond character.

C. C – Cl bond is less polar.

D. C – Cl bond is longer due to repulsion between delocalised electrons of the aromatic ring and lone pairs of electrons of chlorine.

E. The C – Cl bond is formed using sp^2 hybridised orbital of carbon.

Choose the correct answer from the options given below:

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(1) B, C and E Only

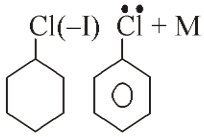
(2) A, D and E Only

(3) B, C and D Only

(4) A, C and E Only

Ans. Official answer NTA (1)

Sol.



(A) → Due to –I & +M both, the negative change on –Cl atom is less in chlorobenzene as compare to cyclohexane (Only–I).

(D) C–Cl bond in chlorobenzene is shorter due to resonance.

Question ID : 444792219

57. 'A' is a neutral organic compound (M. F : C_8H_9ON). On treatment with aqueous $Br_2HO^{(-)}$, 'A' forms a compound 'B' which is soluble in dilute acid. 'B' on treatment with aqueous $NaNO_2/HCl(0\text{-}5°C)$ produces a compound 'C' which on treatment with CuCN/NaCN produces 'D'. Hydrolysis of 'D' produces 'E' which is also obtainable from the hydrolysis of 'A'. 'E' on treatment with acidified $KMnO_4$ produces ' F '. 'F' contains two different types of hydrogen atoms. The structure of 'A' is

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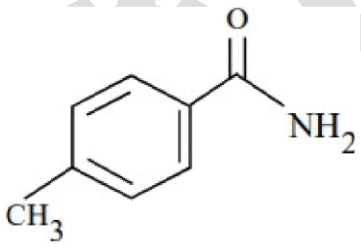
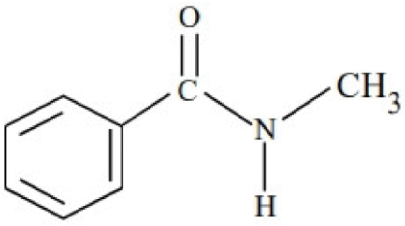
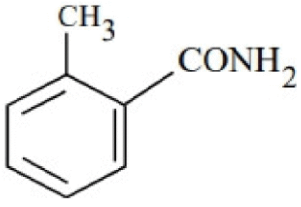
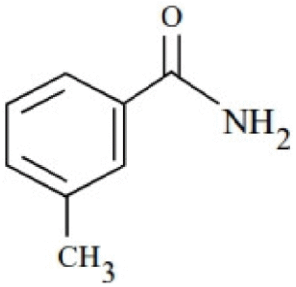
(1) 

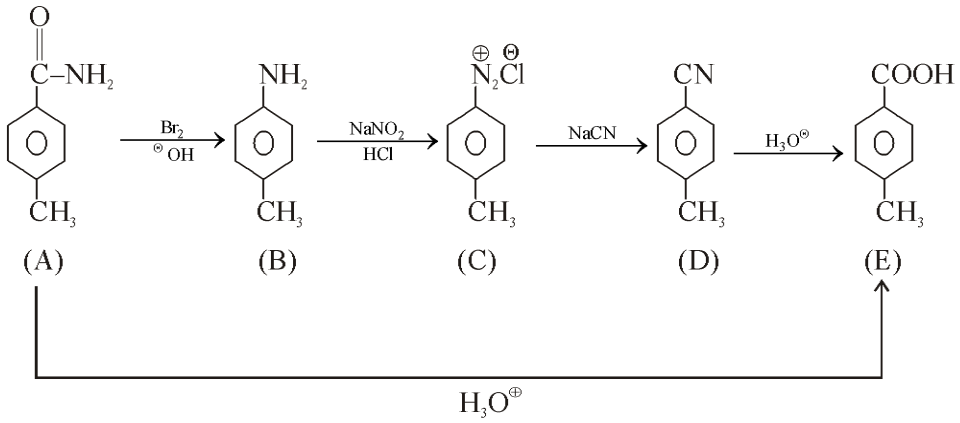
(2) 

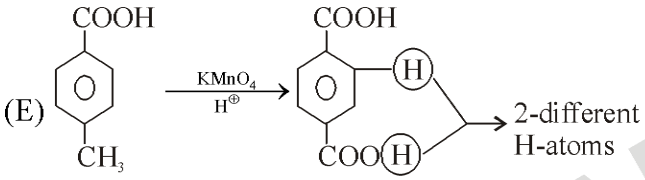
(3) 

(4) 

Ans. Official answer NTA (1)

Sol.





Question ID : 444792205

58. Given below are two statements:

Statement I: The Henry's law constant K_H is constant with respect to variations in solution's concentration over the range for which the solution is ideally dilute.

Statement II: K_H does not differ for the same solute in different solvents.

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 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. Official answer NTA (4)

Sol. Statement I is correct because henry's law is applicable for Ideal dilute sol^n where solute - solute interaction is very less.

Statement II is incorrect because K_H depends on both nature of gas & nature of solvent.

Question ID : 444792210

59. Given below are two statements:

Statement I: The halogen that makes longest bond with hydrogen in HX, has the smallest covalent radius in its group.

Statement II: A group 15 element's hydride EH_3 has the lowest boiling point among corresponding hydrides of other group 15 elements. The maximum covalency of that element E is 4 .

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) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are true

(4) Both Statement I and Statement II are false

Ans. Official answer NTA (4)

Sol. Bond length : $HF < HCl < HBr < HI$

Covalent Radius : $F < Cl < Br < I$

Boiling point : $PH_3 < AsH_3 < NH_3 < SbH_3 < BiH_3$

→ 'I' has largest covalent radius

→ Covalency of P can be greater than 4

Question ID : 444792220

60. Given below are two statements:

Statement I: Sucrose is dextrorotatory. However, sucrose upon hydrolysis gives a solution having mixture of products. This solution shows laevorotation.

Statement II: Hydrolysis of sucrose gives glucose and fructose. Since the laevorotation of glucose is more than the dextrorotation of fructose, the resulting solution becomes laevorotatory.

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 (4)

Sol. $\underset{(d)}{\text{Sucrose}} \xrightarrow{H_3O^{\oplus}} \underset{}{\text{Glucose}} + \underset{(\ell)}{\text{Fructose}}$

Question ID : 444792209

61. Two p-block elements X and Y form fluorides of the type EF_3. The fluoride compound XF_3 is a Lewis acid and YF_3 is a Lewis base. The hybridizations of the central atoms of XF_3 and YF_3 respectively are

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(1) sp^2 and sp^3 (2) Both sp^2 (3) Both sp^3 (4) sp^3 and sp^2

Ans. Official answer NTA (1)

Sol. $XF_3 = BF_3 \Rightarrow B - SP^2$

$YF_3 = NF_3 \Rightarrow N - SP^3$

Question ID : 444792218

62. Match the LIST–I with LIST–II.

List-I Reagents		List-II Name of Reaction involving carbonyl compounds	
A.	$NH_2 - NH_2$, KOH	I.	Tollen's Test
B.	$Ag(NH_3)_2OH$	II.	Clemmensen Reduction
C.	Aq. $CuSO_4$, Sodium Potassium tartarate, KOH	III.	Wolff - Kishner Reduction
D.	Zn - Hg, HCl	IV.	Fehling's Test

Choose the correct answer from the options given below :

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

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

Ans. Official answer NTA (1)

Sol. (A) NH_2–NH_2/KOH → Wolf-Kishner Reduction

(B) $Ag(NH_3)_2OH$ → Tollen's Test

(C) Aq. $CuSO_4$, sodium Potassium Tartarate, KOH → Fehling Test

(D) Zn–Hg/HCl + Clemension Reduction

Question ID : 444792216

63. The correct order of the rate of reaction of the following reactants with nucleophile by S_N1 mechanism is :

(Given : Structures I and II are rigid)

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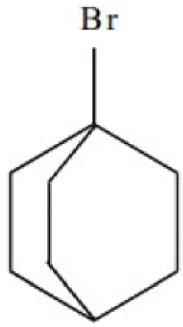
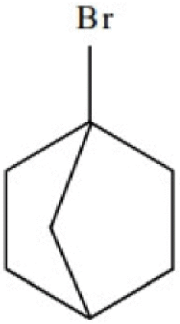
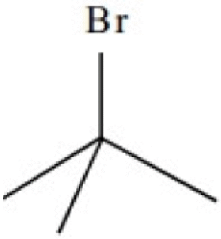
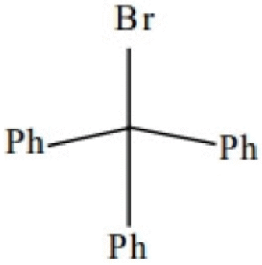
(1) 

(2) 

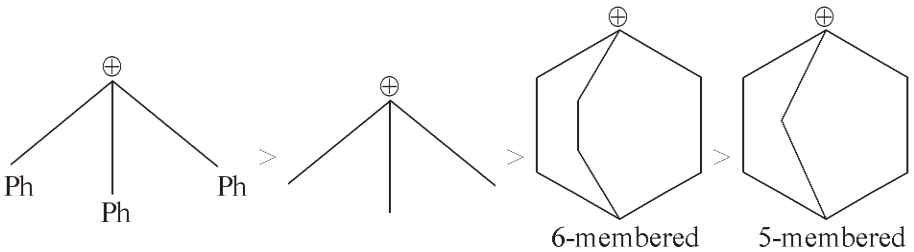
(3) 

(4) 

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

Ans. Official answer NTA (1)

Sol. Rate of $S_N1 \propto$ Stability of carbocation



Question ID : 444792213

64. Given below are two statements:

Statement I: Phenol on treatment with $CHCl_3$/aq. KOH under refluxing condition, followed by acidification produces p-hydroxy benzaldehyde as the major product and o-hydroxy benzaldehyde as the minor product.

Statement II: The mixture of p-hydroxybenzaldehyde and o hydroxybenzaldehyde can be easily separated through steam distillation.

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

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

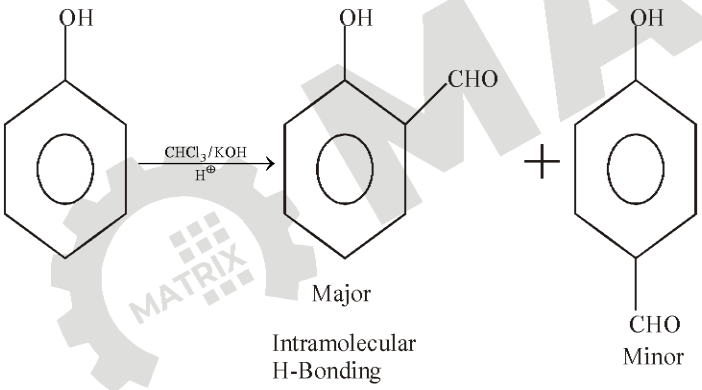
(2) Both Statement I and Statement II are false

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

(4) Both Statement I and Statement II are true

Ans. Official answer NTA (3)

Sol.



Due to intramolecular H-bonding, ortho product is more volatile than para product.

Question ID : 444792206

65. Consider a solution of $CO_2(g)$ dissolved in water in a closed container.

Which one of the following plots correctly represents variation of log (partial pressure of CO_2 in vapour phase above water) [y-axis] with log (mole fraction of CO_2 in water) [x-axis] at 25°C ?

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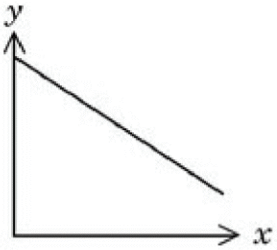
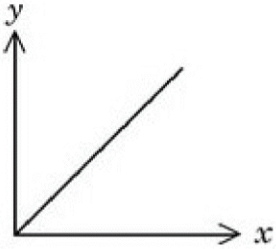
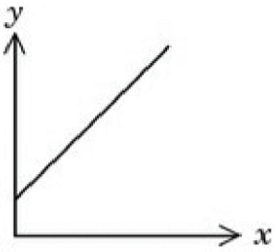
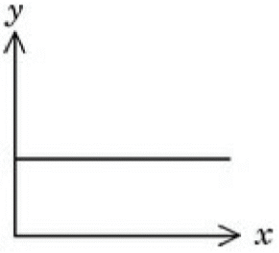
(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (3)

Sol. $P = K_H.X$

$\log P = \log K_H + \log X$

$y = c + m.x$

$m = 1$

$C = K_H = +ve\ value$

Question ID : 444792201

66. In the reaction,

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$2\ Al(s) + 6HCl(aq) \rightarrow 2\ Al^{3+}(aq) + 6\ Cl^{-}(aq) + 3\ H_2(g)$

(1) 11 .2 L $H_2(g)$ at STP is produced for every mole of HCl consumed.

(2) 33.6 L $H_2(g)$ is produced regardless of temperature and pressure for every mole of Al that reacts.

(3) 12 L HCl(aq) is consumed for every 6 L $H_2(g)$ produced.

(4) 67.2 L $H_2(g)$ at STP is produced for every mole of Al that reacts.

Ans. Official answer NTA (1)

Sol. (1) 6 mole HCl produces 3 moles H_2

$1\ mole\ HCl \rightarrow \frac{1}{2} mole\ H_2 \Rightarrow (V_{H_2})_{STP} = \frac{1}{2} \times 22.4 = 11.2L$

(2) Only at STP

(3) volume -volume comparison is only applied for gases (Gay -Lussac's Law)

(4) 1 mole Al produce $\frac{3}{2} mol\ H_2$

$$\left(V_{H_2}\right)_{STP} = \frac{3}{2} \times 22.4 = 33.6\,L$$

Question ID : 444792214

67. The correct order of reactivity of CH_3Br in methanol with the following nucleophiles is

F^-, I^-, $C_2H_5O^-$ and $C_6H_5O^-$

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(1) $I^- > C_6H_5O^- > F^- > C_2H_5O^-$

(2) $I^- > C_2H_5O^- > C^6H_5O^- > F^-$

(3) $I^- > C_2H_5O^- > F^- > C_6H_5O^-$

(4) $I^- > F^- > C_6H5O^- > C_2H_5O^-$

Ans. Official answer NTA (2)

Sol. more the charge density, more is the solvation & more is the size after solvation.

size

after solvation $F^{\ominus} > O^{\ominus} > I^{\ominus}$

By PP solvent

So, nucleophilicity decreases

Question ID : 444792204

68.

	List-I Thermodynamic Process		List-II Magnitude in kJ
A.	Work done in reversible, isothermal expansion of 2 mol of ideal gas from 2 dm^3 to 20 dm^3 at 300 K.	I.	4
B.	Work done in irreversible isothermal expansion of 1 mol ideal gas from 1 m^3 to 3 m^3 at 300 K against a constant pressure of 3kPa.	II.	11.5
C.	Change in internal energy for adiabatic expansion of a 1 mol ideal gas with change of temperature = 320 K and $\bar{C}_V = \frac{3}{2}R$.	III.	6
D.	Change in enthalpy at constant pressure of 1 mol ideal gas with change of temperature = 337 K and $\bar{C}_p = \frac{5}{2}R$.	IV.	7

Choose the correct answer from the options given below :

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

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

Ans. Official answer NTA (3)

Sol. (A) $W = -2.303nRT\log\frac{V_2}{V_1}$

$= 2.303\times 2\times\frac{25}{3}\times 300\log\frac{20}{2} = -11.5\text{ kJ}$

(B) $W = -P_{ext}\left(V_2 - V_1\right)$

$= -(3\times 10^3)(3-1)$

$= -6\times 10^3\text{ J} = -6\text{kJ}$

(C) $\Delta U = nCp\,\Delta T$

$= 1\times\frac{3}{2}\times\frac{25}{3}\times(-320)$

$= -4000 = -4\text{kJ}$

(D) $\Delta H = nCp\Delta T$

$= 1\times\frac{5}{2}\times\frac{25}{3}\times 337$

$= 7020\text{ J} = 7\text{ kJ}$

Question ID : 444792211

69. A first row transition metal (M) does not liberate H_2 gas from dilute HCl .1 mol of aqueous solution of MSO_4 is treated with excess of aqueous KCN and then $H_2S(g)$ is passed through the solution. The amount of MS (metal sulphide) formed from the above reaction is _____ mol.

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(1) 1 (2) 3 (3) 2 (4) 0

Ans. Official answer NTA (4)

Sol. $Cu + \text{dil.HCl} \rightarrow \text{No Reaction}$

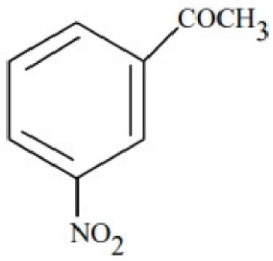
$CuSO_4 + \underset{(\text{excess})}{KCN} \rightarrow \left[Cu(CN)_4\right]^{3-} + (CN)_2\uparrow$

$\underset{(\text{Stable})}{[Cu(CN)_4]^{3-}} + H_2S \rightarrow \text{no ppt.}$

Question ID : 444792215

70. Given below are two statements:

Statement I: Benzene is nitrated to give nitrobenzene, which on further treatment

with $CH_3COCl / AlCl_3$ will give 

Statement II: $-NO_2$ group is a m-directing, and deactivating group.

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

क

(1) Statement I is incorrect but Statement II is correct

(2) Both Statement I and Statement II are incorrect

(3) Statement I is correct but Statement II is incorrect

(4) Both Statement I and Statement II are correct

Ans. Official answer NTA (1)

Sol. Friedal craft acylation of nitrobenzene is not possible due to presence of strong deactivating group $-NO_2$

SECTION – B

Question ID : 444792224

71. The cycloalkene (X) on bromination consumes one mole of bromine per mole of (X) and gives the product (Y) in which C: Br ratio is 3: 1. The percentage of bromine in the product (Y) is _____%. (Nearest integer)

(Given : molar mass in g mol^{-1} H : 1, C : 12, O : 16, Br : 80)

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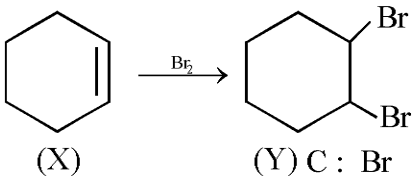
Ans. Official answer NTA (66)

Sol. 

(X) (Y) C : Br (3 : 1)

$$\%Br = \frac{2\times 80}{72160+10}\times 100 = 66.11\%$$

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72. Sodium fusion extract of an organic compound (Y) with $CHCl_3$ and chlorine water gives violet color to the $CHCl_3$ layer. 0.15 g of (Y) gave 0.12 g of the silver halide precipitate in Carius method. Percentage of halogen in the compound (Y) is_____ . (Nearest integer)

(Given : molar mass g mol^{-1} C : 12, H : 1, Cl : 35.5, Br : 80, I : 127)

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Ans. Official answer NTA (43)

Sol. Violet colour is due to I_2

$$\%\text{of I} = \frac{\text{Atomic weight of I}}{\text{Molecular weight of AgI}}\times\frac{m}{W}\times 100$$

$$= \frac{127}{235}\times\frac{0.12}{0.15}\times 100 = 43.23\%$$

$\simeq 43\%$

Here, m = mass of AgI formed

w = mass of organic compound (y)

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73. The temperature at which the rate constants of the given below two gaseous reactions become equal is _____ K. (Nearest integer).

$$X \longrightarrow Y \qquad k_1 = 10^6 e^{\frac{-30000}{T}}$$

$$P \longrightarrow Q \qquad k_2 = 10^4 e^{\frac{-24000}{T}}$$

Given : In 10 = 2.303

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Ans. Official answer NTA (1303)

Sol. $$10^6\left(e^{-\frac{3\times 10^4}{T}}\right) = 10^4\left(e^{-\frac{24\times 10^4}{T}}\right)$$

$$\Rightarrow e^{\frac{600}{T}} = 100 = 10^2$$

$\Rightarrow \frac{6000}{T} = 2\ell n10$

$T = 1302.6\ K$

$= 1303\ K$

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74. Dissociation of a gas A_2 takes place according to the following chemical reaction.

At equilibrium, the total pressure is 1 bar at 300 K .

$A_2(g) \rightleftharpoons 2A(g)$

The standard Gibbs energy of formation of the involved substances has been provided below:

Substance	ΔG_f° / kJ mol^{-1}
A_2	−100.00
A	−50.832

The degree of dissociation of $A_2(g)$ is given by $(x \times 10^{-2})^{1/2}$ where x = _____ . (Nearest integer).

[Given: R = 8 J mol^{-1} K^{-1}, log 2 = 0.3010, log 3 = 0.48]

Assume degree of dissociation is not negligible.

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Ans. Official answer NTA (33)

Sol. $\Delta G^0_{R\times N} = 2\Delta G^0_f(A) - \Delta G^0_f(A_2)$

$= 2\times(-50.832) - (-100)$

$= -1.664\ kJ\ mol^{-1}$

$= -RT\ln k_p$

$= -8 \times 300 \times \ln k_p$

$\ln k_p = 0.69$

$k_p = 2$

$A_2 \rightleftharpoons 2A$

1 mol

$1-\alpha \quad 2\alpha$

$k_p = \frac{(2\alpha)^2}{(1-\alpha)} \times \left(\frac{1}{1+\alpha}\right)^1$

$$2 = \frac{4\alpha^2}{1-\alpha^2}$$

$$\alpha = \left(\frac{1}{3}\right)^{\frac{1}{2}}$$

$$\alpha = \left(3.33\times10^{-2}\right)^{\frac{1}{2}}$$

x = 33

Question ID : 444792222

75. Consider the following electrochemical cell at 298 K

$Pt|\ HSnO_2^-(aq)\ |\ Sn(OH)_6^{2-}(aq)\ |\ OH^-(aq)\ |\ Bi_2O_3(s)\ |\ Bi(s)$.

If the reaction quotient at a given time is 10^6, then the cell EMF (E_{cell}) is _____ $\times 10^{-1}$ V (Nearest integer).

Given the standard half-cell reduction potential as

$E^o_{Bi_2O_3/Bi,OH^-} = -0.44V$ and $E^o_{Sn(OH)_6^{2-}/HSnO_2^-,OH^-} = -0.90V$

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Ans. Official answer NTA (4)

Sol. $E^0_{cell} = -0.44-(-0.9)$

$= 0.46$

$$E_{cell} = E^0_{cell} - \frac{0.06}{n}\log_{10}10^6$$

$$E^0_{cell} = 0.46 - \frac{0.06}{6}\times 6$$

$= 0.4$

$= 4\times10^{-1}$

Anode - $3\times[HSnO_2^- + 3OH^- + H_2O \rightarrow Sn(OH)_6^{2-} + 2e^-]$

Cathode - $[Bi_2O_3 + 3H_2O + 6e^- \rightarrow 2Bi + 6OH^-]$