JEE Main January 2025

Question Paper With Text Solution

24 January | Shift-1

CHEMISTRY

MATRIX

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

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JEE MAIN JANUARY 2025 | 24TH JANUARY SHIFT-1

SECTION – A

Question ID : 7364751112

51. One mole of the octahedral complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with excess of $AgNO_3$ solution to yield two moles of AgCl(s). The structure of the complex is:

(1) $[Co(NH_3)_3Cl_3]\cdot 2NH_3$

(2) $[Co(NH_3)_4Cl_2]\cdot Cl\cdot NH_3$

(3) $[Co(NH_3)_4Cl]\cdot Cl_2\cdot NH_3$

(4) $[Co(NH_3)_5Cl]Cl_2$

Ans. Official answer NTA (4)

Sol.

Question ID : 7364751102

52. Which of the following statement is true with respect to H_2O, NH_3 and CH_4 ?

A. The central atoms of all the molecules are sp^3 hybridized.

B. The $H-O-H, H-N-H$ and $H-C-H$ angles in the above molecules are $104.5^\circ, 107.5^\circ$ and 109.5°, respectively.

C. The increasing order of dipole moment is $CH_4 < NH_3 < H_2O$

D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.

E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.

Choose the correct answer from the options given below:

(1) C, D and E Only

(2) A, B and C Only

(3) A, D and E Only

(4) A, B, C and E Only

Ans. Official answer NTA (2)

Sol.

Question ID : 7364751111

53. Preparation of potassium permanganate from MnO_2 involves two step process in which the 1st step is a reaction with KOH and KNO_3 to produce

(1) $K_4\left[Mn(OH)_6\right]$

(2) $KMnO_4$

(3) K_2MnO_4

(4) K_3MnO_4

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751106

54. For the given cell

$$Fe^{2+}_{(aq)} + Ag^{+}_{(aq)} \rightarrow Fe^{3+}_{(aq)} + Ag_{(s)}$$

The standard cell potential of the above reaction is

Given :

$Ag^{+} + e^{-} \rightarrow Ag$ $\quad E^{\theta} = xV$

$Fe^{2+} + 2e^{-} \rightarrow Fe$ $\quad E^{\theta} = yV$

$Fe^{3+} + 3e^{-} \rightarrow Fe$ $\quad E^{\theta} = zV$

(1) $x + y - z$

(2) $x + 2y - 3z$

(3) $y - 2x$

(4) $x + 2y$

Ans. Official answer NTA (2)

Sol.

Question ID : 7364751113

55. Given below are two statements I and II.

Statement I: Dumas method is used for estimation of "Nitrogen" in an organic compound.

Statement II: Dumas method involves the formation of ammonium sulphate by heating the organic compound with conc H_2SO_4.

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

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

(2) Both Statement I and Statement II are false

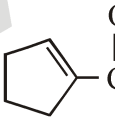
(3) Statement I is false but Statement II is true

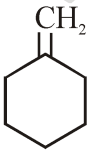
(4) Both Statement I and Statement II are true

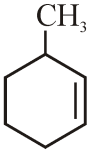
Ans. Official answer NTA (1)

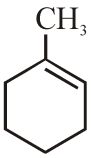
Sol.

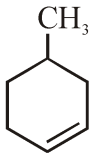
Question ID : 7364751117

56. Aman has been asked to synthesise the molecule  (x). He thought of preparing the molecule using an aldol condensation reaction. He found a few cyclic alkenes in his laboratory. He thought of performing ozonolysis reaction on alkene to produce a dicarbonyl compound followed by aldol reaction to prepare " x ". Predict the suitable alkene that can lead to the formation of "x".

(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751105

57. K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30}. What is the molar solubility of this salt in water?

(1) $\sqrt[2]{1.6\times10^{-30}}$

(2) $\sqrt[4]{\frac{1.6\times10^{-30}}{27}}$

(3) $\frac{1.8\times10^{-30}}{27}$

(4) $\sqrt[5]{1.8\times10^{-30}}$

Ans. Official answer NTA (2)

Sol.

Question ID : 7364751120

58. The carbohydrate "Ribose" present in DNA, is

A. A pentose sugar

B. present in pyranose from

C. in "D" configuration

D. a reducing sugar, when free

E. in α-anomeric form

Choose the correct answer from the options given below:

(1) B, D and E Only

(2) A, B and E Only

(3) A, C and D Only

(4) A, D and E Only

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751118

59. Which of the following arrangements with respect to their reactivity in nucleophilic addition reaction is correct?

(1) benzaldehyde < acetophenone < p- nitrobenzaldehyde < p-tolualdehyde

(2) p- nitrobenzaldehyde < benzaldehyde < p-tolualdehyde < acetophenone

(3) acetophenone < benzaldehyde < p-tolualdehyde < p- nitrobenzaldehyde

(4) acetophenone < p-tolualdehyde < benzaldehyde < p- nitrobenzaldehyde

Ans. Official answer NTA (4)

Sol.

Question ID : 7364751103

60. Let us consider an endothermic reaction which is non-spontaneous at the freezing point of water. However, the reaction is spontaneous at boiling point of water. Choose the correct option.

(1). ΔH is (+v) but ΔS is (-ve)

(2) Both ΔH and ΔS are (+ve)

(3) ΔH is (-ve) but ΔS is (+ve)

(4) Both ΔH and ΔS are (-ve)

Ans. Official answer NTA (2)

Question ID : 7364751109

61. The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of

(1) Atomicity

(2) Electron gain enthalpy

(3) Electronegativity

(4) Atomic size

Ans. Official answer NTA (1)

Sol.

Question ID : 7364751107

62. For a reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ in a constant volume container, no products were present initially. The final pressure of the system when 50 % of reaction gets completed is

(1) 7 / 4 times of initial pressure

(2) 5 times of initial pressure

(3) 7 / 2 times of initial pressure

(4) 5/2 times of initial pressure

Ans. Official answer NTA (1)

Sol.

Question ID : 7364751101

63. Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z-direction] ?

A. 2 p_z and $2p_x$

B. 2 s and 2 p_x

C. $3d_{xy}$ and $3d_{x^2-y^2}$

D. 2 s and $2p_z$

E. 2 p_z and $3d_x{}^2 - y^2$

Choose the correct answer from the options given below:

(1) E Only

(2) A and B Only

(3) C and D Only

(4) D Only

Ans. Official answer NTA (4)

Sol.

Question ID : 7364751116

64. Given below are two statements:

Statement I: The conversion proceeds well in the less polar medium .

$$CH_3-CH_2-CH_2-CH_2-Cl \xrightarrow{HO^-} CH_3-CH_2-CH_2-CH_2-OH + Cl^{(-)}$$

Statement II: The conversion proceeds well in the more polar medium .

$$CH_3-CH_2-CH_2-CH_2-Cl \xrightarrow{R_3\ddot{N}} CH_3-CH_2-CH_2-CH_2-\overset{\overset{R}{|}}{\underset{\underset{R}{|}}{N^{(+)}}}-RCl^{(-)}$$

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 true but Statement II is false

(3) Both Statement I and Statement II are true

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

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751108

65. Which of the following statements are NOT true about the periodic table?

A. The properties of elements are function of atomic weights.

B. The properties of elements are function of atomic numbers.

C. Elements having similar outer electronic configurations are arranged in same period.

D. An element's location reflects the quantum numbers of the last filled orbital.

E. The number of elements in a period is same as the number of atomic orbitals available in energy level that is being filled.

Choose the correct answer from the options given below:

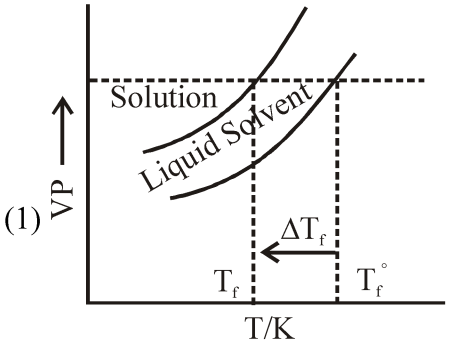
(1) D and E Only (2) A and E Only (3) A, C and E Only (4) B, C and E Only

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751104

66. Consider the given plots of vapour pressure (VP) vs temperature(T/K). Which amongst the following options is correct graphical representation showing ΔT_f, depression in the freezing point of a solvent in a solution?

(1)


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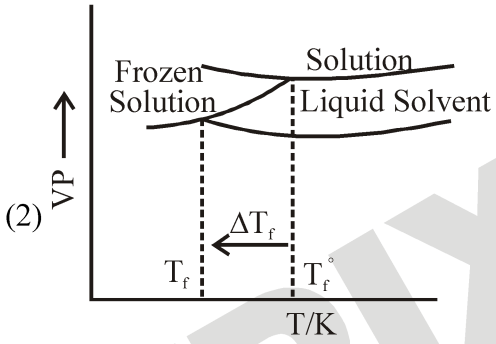

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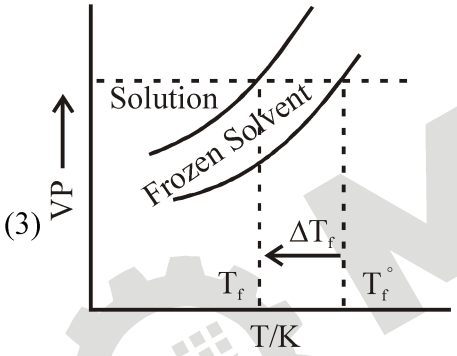

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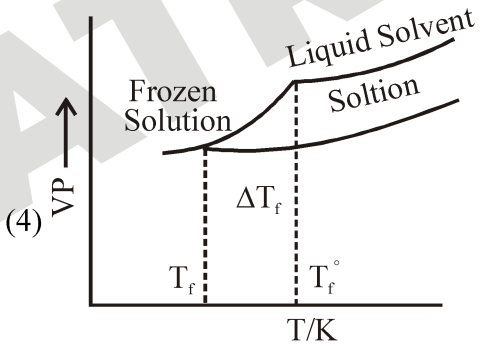


Ans. Official answer NTA (4)

Sol.

Question ID : 7364751110

67. Which of the following ions is the strongest oxidizing agent?

(Atomic Number of Ce = 58, Eu = 63, Tb = 65, Lu = 71)

(1) Eu^{2+}

(2) Ce^{3+}

(3) Lu^{3+}

(4) Tb^{4+}

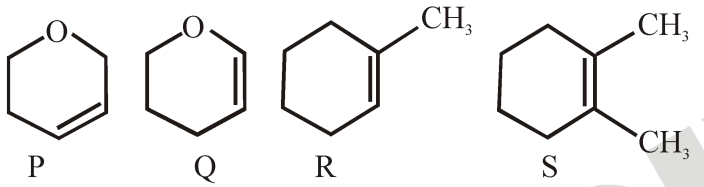
Ans. Official answer NTA (4)

Sol.

Question ID : 7364751115

68. Following are the four molecules " P ", "Q", " R " and " S ".

Which one among the four molecules will react with $H - Br_{(aq)}$ at the fastest rate?



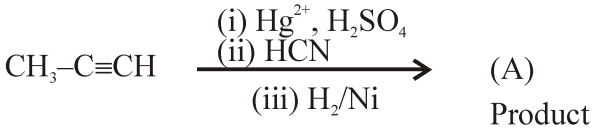
(1) Q (2) P (3) R (4) S

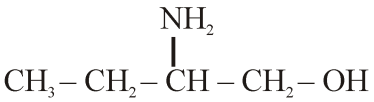
Ans. Official answer NTA (1)

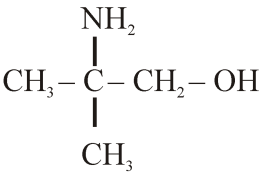
Sol.

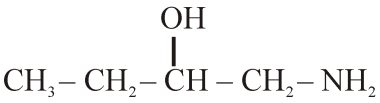
Question ID : 7364751119

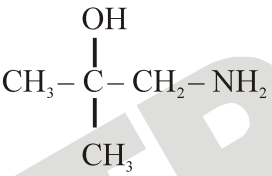
69. The product (A) formed in the following reaction sequence is



(1) 

(2) 

(3) 

(4) 

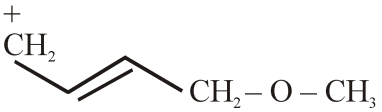
Ans. Official answer NTA (4)

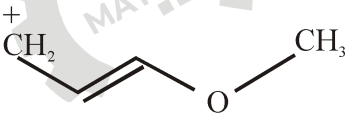
Sol.

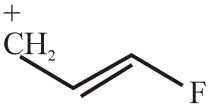
Question ID : 7364751114

70. Which one of the carbocations from the following is most stable?

(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (3)

Sol.

SECTION – B

Question ID : 7364751125

71. Among the following cations, the number of cations which will give characteristic precipitate in their identification tests with $K_4[Fe(CN)_6]$ is _____.

$Cu^{2+}, Fe^{3+}, Ba^{2+}, Ca^{2+}, NH_4^+, Mg^{2+}, Zn^{2+}$

Ans. Official answer NTA (3)

Sol.

Question ID : 7364751122

72. Standard entropies of X_2, Y_2 and XY_5 are 70, 50 and 110 J K^{-1} mol^{-1} respectively. The temperature in Kelvin at which the reaction

$$\frac{1}{2}X_2 + \frac{5}{2}Y_2 \rightleftharpoons XY_5 \Delta H^{\Theta} = -35\,kJ\,mol^{-1}$$

will be at equilibrium is _____ (Nearest integer)

Ans. Official answer NTA (700)

Sol.

Question ID : 7364751124

73. Xg of benzoic acid on reaction with aq $NaHCO_3$ released CO_2 that occupied 11.2 L volume at STP.

X is _____ g.

Ans. Official answer NTA (61)

Sol.

Question ID : 7364751121

74. Consider the following reaction occurring in the blast furnace:

$$Fe_3O_{4(s)} + 4CO_{(g)} \rightarrow 3Fe_{(l)} + 4CO_{2(g)}$$

'x' kg of iron is produced when 2.32×10^3 kgFe_3O_4 and 2.8×10^2 kgCO are brought together in the furnace. The value of 'x' is _____ (nearest integer)

{Given:

molar mass of $Fe_3O_4 = 232\,g\,mol^{-1}$

molar mass of $CO = 28\,g\,mol^{-1}$

molar mass of $Fe = 56\,g\,mol^{-1}$ }

Ans. Official answer NTA (420)

Sol.

Question ID : 7364751123

75. 37.8 g N_2O_5 was taken in a 1 L reaction vessel and allowed to undergo the following reaction at 500 K

$$2N_2O_{5(g)} \rightleftharpoons 2N_2O_{4(g)} + O_{2(g)}$$

The total pressure at equilibrium was found to be 18.65 bar.

Then, Kp = _____ 10^{-2} [nearest integer]

Assume N_2O_5 to behave ideally under these conditions.

Given: R = 0.082$ bar L mol^{-1} K^{-1}

Ans. Official answer NTA (962)

Sol.