JEE Main January 2025
Question Paper With Text Solution
23 January | Shift-2

CHEMISTRY

JEE MAIN JANUARY 2025 | 23ᵀᴴ JANUARY SHIFT-2

SECTION – A

Question ID : 656445445

51.   The α-alpha and α-Helix and β-Pleated sheet structures of protein are associated with its :

(1) secondary structure

(2) quaternary structure

(3) tertiary structure

(4) primary structure

Ans.   Official answer NTA (1)

Sol.

Question ID : 656445433

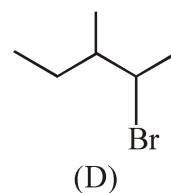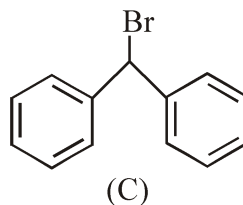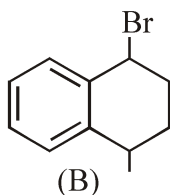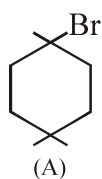52.   pH of water is 7 at 25ºC. If water is heated to 80ºC, it's pH will :

(1) Decrease

(2) H^+ concentration increases, OH^- concentration decreases

(3) Remains the same

(4) Increase

Ans.   Official answer NTA (1)

Sol.

Question ID : 656445442

53.   The ascending order of relative rate of solvolysis of following compounds is :

(1) (C) < (B) < (A) < (D)

(2) (D) < (A) < (B) < (C)

(3) (D) < (B) < (A) < (C)

(4) (C) < (D) < (B) < (A)

Ans.   Official answer NTA (2)

Sol.

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Question ID : 656445435

54.   Given below are the atomic numbers of some group 14 elements. The atomic number of the element with lowest melting point is :

(1) 14   (2) 82   (3) 50   (4) 6

Ans.   Official answer NTA (3)

Sol.

Question ID : 656445430

55.   Consider a binary solution of two volatile liquid components 1 and 2 . x_1 and y_1 are the mole fractions of component 1 in liquid and vapour phase, respectively. The slope and intercept of the linear plot of $\dfrac{1}{x_1}$ vs $\dfrac{1}{y_1}$ are given respectively as :

(1) $\dfrac{P_1^0}{P_2^0}, \dfrac{P_2^0 - P_1^0}{P_2^0}$ (2) $\dfrac{P_2^0}{P_1^0}, \dfrac{P_1^0 - P_2^0}{P_2^0}$ (3) $\dfrac{P_2^0}{P_1^0}, \dfrac{P_2^0 - P_1^0}{P_2^0}$ (4) $\dfrac{P_1^0}{P_2^0}, \dfrac{P_1^0 - P_2^0}{P_2^0}$

Ans.   Official answer NTA (1)

Sol.

Question ID : 656445438

56.   Identify the coordination complexes in which the central metal ion has d^4 configuration.

(A) $\left[FeO_4\right]^{2-}$ (B) $\left[Mn(CN)_6\right]^{3-}$ (C) $\left[Fe(CN)_6\right]^{3-}$ (D) $Cr_2(O\overset{\overset{\displaystyle O}{\|}}{-C}-Me)_4(H_2O)_2$

Choose the correct answer from the options given below :

(1) (A), (B) and (E) only   (2) (C) and (E) only

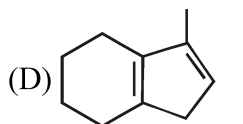(3) (B) and (D) only   (4) (B), (C) and (D) only
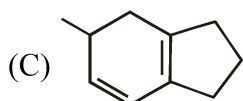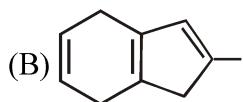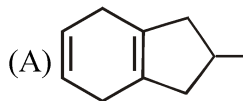
Ans.   Official answer NTA (3)

Sol.

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Question ID : 656445441

57.   Match List - I with List - II.

List - I

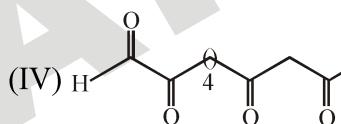(Isomers of $C_{10}H_{14}$)

(A) <image: bicyclic hydrocarbon with methyl substituent>

(B) <image: bicyclic hydrocarbon with methyl substituent>

(C) <image: bicyclic hydrocarbon with methyl substituent>

(D) <image: bicyclic hydrocarbon with methyl substituent>

List - II

(Ozonolysis product)

(I) <image: dialdehyde/diketone structure>

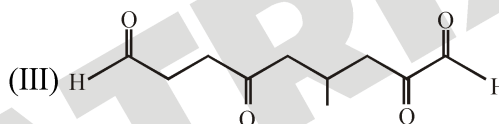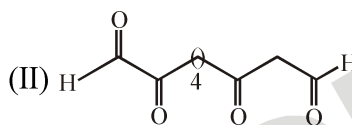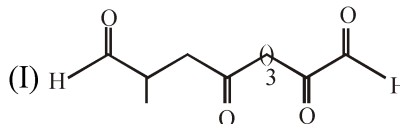(II) <image: dialdehyde/diketone structure>

(III) <image: dialdehyde/diketone structure>

(IV) <image: dialdehyde/diketone structure>

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

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

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

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

Ans.   Official answer NTA (3)

Sol.

Question ID : 656445427

58.   The effect of temperature on spontaneity of reactions are represented as

ΔH	ΔS	Temperature	Spontaneity
(A) +	–	any T	Non spontaneous
(B) +	+	low T	spontaneous
(C) –	–	low T	Non spontaneous
(D) –	+	any T	spontaneous

The incorrect combinations are :

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

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Ans. Official answer NTA (2)

Sol.

Question ID : 656445428

59. Standard electrode potentials for a few half cells are mentioned below :

$$E^{\circ}_{Cu^{2+}/Cu} = 0.34 \text{ V}, E^{\circ}_{Zn^{2+}/Zn} = -0.76 \text{ V}$$

$$E^{0}_{Ag^{+}/Ag} = 0.80 \text{ V}, E^{0}_{Mg^{2+}/Mg} = -2.37 \text{ V}$$

Which one of the following cells gives the most negative value of ΔG° ?

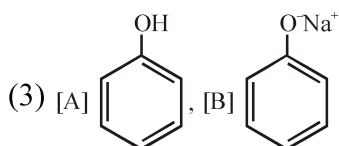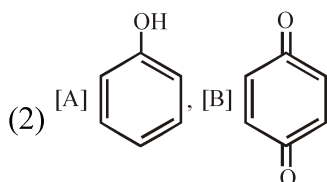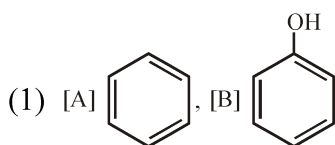(1) $Zn\left|Zn^{2+}(1M)\right\|Ag^{+}(1M)\left|Ag\right.$

(2) $\left|Zn^{2+}(1M)\right\|Mg^{2+}(1M)\left|Mg\right.$

(3) $Ag\left|Ag^{+}(1M)\right\|Mg^{2+}(1M)\left|Mg\right.$

(4) $Cu\left|Cu^{2+}(1M)\right\|Ag^{+}(1M)\left|Ag\right.$

Ans. Official answer NTA (1)

Sol.

Question ID : 656445443

60. Identify the products [A] and [B], respectively in the following reaction :
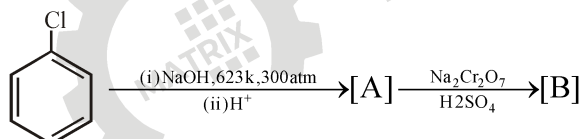
(1) [A] , [B]

(2) [A] , [B]

(3) [A] , [B]

(4) [A] , [B]

Ans.

Ans. Official answer NTA (2)

Question ID : 656445439

61. Identify A, B and C in the given below sequence
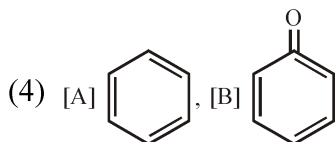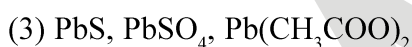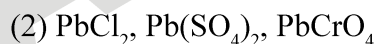
$$\boxed{A} \xrightarrow{HNO_3} Pb(NO_3)_2 \xrightarrow{H_2SO_4} \boxed{B} \xrightarrow[\substack{(1)\ Ammonimm\ acetate \\ (2)\ Acetic\ acid \\ (3)\ K_2CrO_4}]{} \boxed{C}$$

Yellow ppt

(1) PbS, PbSO$_4$, PbCrO$_4$ (2) PbCl$_2$, Pb(SO$_4$)$_2$, PbCrO$_4$

(3) PbS, PbSO$_4$, Pb(CH$_3$COO)$_2$ (4) PbCl$_2$, PbSO$_4$, PbCrO$_4$

Ans. Official answer NTA (1)

Sol.
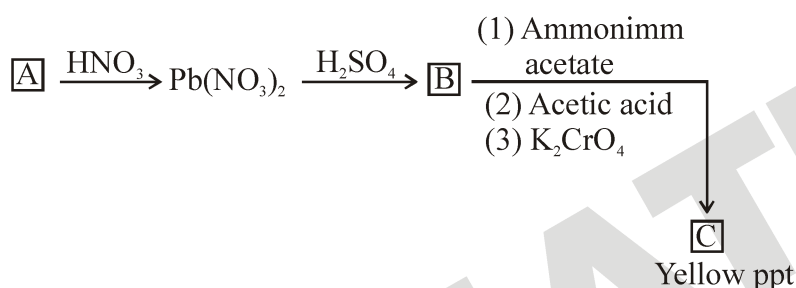
Question ID : 656445429

62. When a non-volatile solute is added to the solvent, the vapour pressure of the solvent decreases by 10 mm of Hg . The mole fraction of the solute in the solution is 0.2 . What would be the mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg ?

(1) 0.4   (2) 0.8   (3) 0.2   (4) 0.6

Ans. Official answer NTA (4)

Sol.

Question ID : 656445437

63.   Match List - I with List - II.

List-I

(A) Bronze

(B) Brass

(C) UK silver coin

(D) Stainless steel

List-II

(I) Cu, Ni

(II) Fe, Cr, Ni, C

(III) Cu, Zn

(IV) Cu, Sn

Choose the correct answer from the options given below :

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

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

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

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

Ans.   Official answer NTA (4)

Sol.

Question ID : 656445440

64.   Given below are two statements :

Consider the following reaction

Statement (I): In the case of formaldehyde (H—C—H), K is about 2280, due to small substituents, hydration is faster.

Statement (II): In the case of trichloro acetaldehyde $\left(\begin{array}{c} O \\ \| \\ H-C-C-Cl \\ | \\ Cl \end{array} \right)$ K is about 2000 due to - I effect of -Cl.

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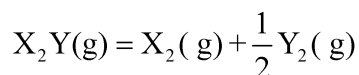
(3) Statement I is false but Statement II is true

(4) Both Statement I and Statement II are false

Ans. Official answer NTA (1)

Sol.

Question ID : 6564454310

65. Consider the reaction

$$X_2Y(g) = X_2(g) + \frac{1}{2}Y_2(g)$$

The equation representing correct relationship between the degree of dissociation (x) of $X_2Y(g)$ with its equilibrium constant Kp is ....

Assume x to be very very small.

(1) $x = \sqrt[3]{\dfrac{Kp}{2p}}$ (2) $x = \sqrt[3]{\dfrac{Kp}{p}}$ (3) $x = \sqrt[3]{\dfrac{2Kp}{p}}$ (4) $x = \sqrt[3]{\dfrac{2Kp^2}{p}}$
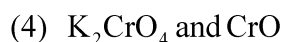
Ans. Official answer NTA (4)

Sol.

Question ID : 656445436

66. Consider the following reactions

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} [A] \xrightarrow[-H_2O]{H_2SO_4} [B] + K_2SO_4$$

The products [A] and [B], respectively are :

(1) K_2CrO_4 and $K_2Cr_2O_7$ (2) $K_2Cr(OH)_6$ and Cr_2O_3

(3) K_2CrO_4 and Cr_2O_3 (4) K_2CrO_4 and CrO

Ans. Official answer NTA (1)

Sol.
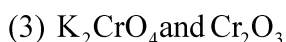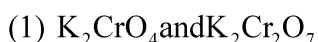
Question ID : 656445432

67. Which of the folllowing graphs most appropriately represents a zero order reaction ?

(1)

(2)

(3)

(4)

Ans. Official answer NTA (3)

Sol.

Question ID : 656445434

68. Given below are two statements about X-ray spectra of elements :
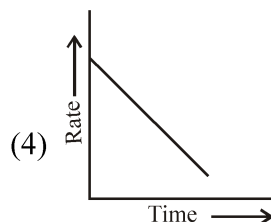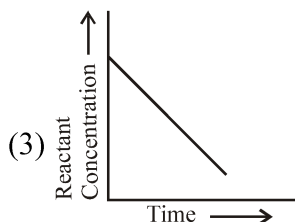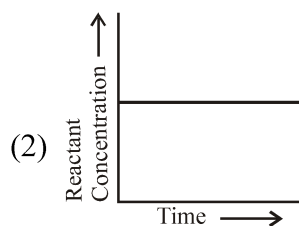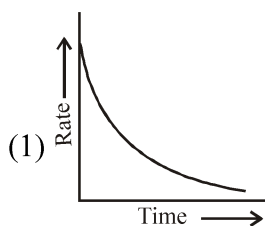
Statement (I): A plot of $\sqrt{v}$ (v = frequency of X-rays emitted) vs atomic mass is a straight line.

Statement (II) : A plot of v(v = frequency of X-rays emitted) vs atomic number is a straight line.

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

(4) Both Statement I and Statement II are false

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

Ans. Official answer NTA (4)

Sol.

Question ID : 656445444

69. Given below are two statements :

Statement (I) : The boiling points of alcohols and phenols increase with increase in the number of C-atoms.

Statement (II) : The boiling points of alcohols and phenols are higher in comparison to other class of compounds such as ethers, haloalkanes.

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

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(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 : 656445426

70.   Given below are two statements :

Statement (I) : For a given shell, the total number of allowed orbitals is given by n^2.

Statement (II) : For any subshell, the spatial orientation of the orbitals is given by $-l$ to $+l$ values including zero.

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.

SECTION – B

Question ID : 656445448

71.   0.01 mole of an organic compound (X) containing 10% hydrogen, on complete combustion produced 0.9g H_2O. Molar mass of (X) is _____ g mol^{-1}.

Ans. Official answer NTA (100)

Sol.

Question ID : 656445446

72. When 81.0 g of aluminium is allowed to react with 128.0 g of oxygen gas, the mass of aluminium oxide produced in grams is _____ (Nearest integer)
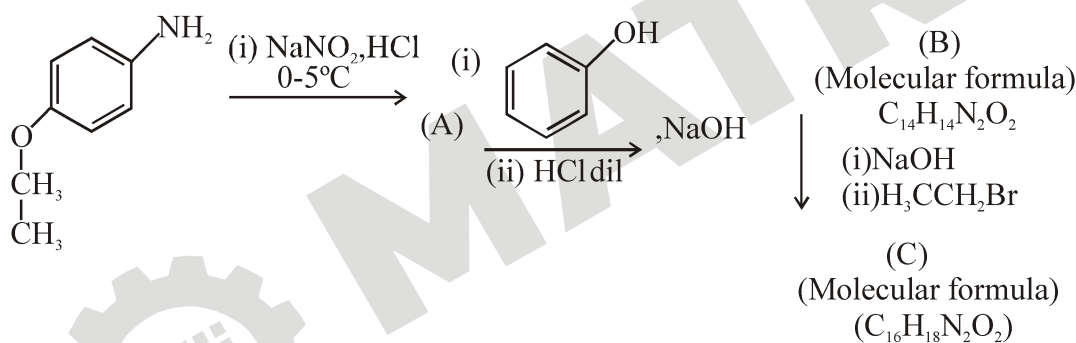
Given :

Molar mass of Al is 27.0 g mol^{-1}

Molar mass of O is 16.0 g mol^{-1}

Ans. Official answer NTA (153)

Sol.

Question ID : 656445450
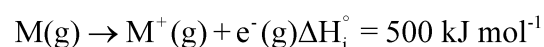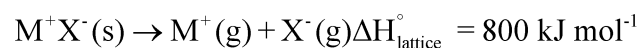
73. Consider the following sequence of reactions.

Total number of sp^3 hydridised carbon atoms in the major product C formed is _____ .
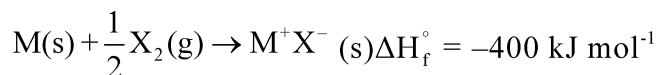
Ans. Official answer NTA (4)

Sol.

Question ID : 656445447
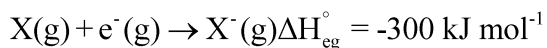
74. The bond dissociation enthalpy of X_2 ΔH°_{bond} calculated from the given data is_____ kJ mol^{-1}. (Nearest integer)

$$M^+ X^- (s) \rightarrow M^+ (g) + X^- (g) \Delta H^{\circ}_{lattice} = 800 \text{ kJ mol}^{-1}$$

$$M(s) \rightarrow M(g) \Delta H^{\circ}_{sub} = 100 \text{ kJ mol}^{-1}$$

$$M(g) \rightarrow M^+ (g) + e^- (g) \Delta H^{\circ}_{i} = 500 \text{ kJ mol}^{-1}$$

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$X(g) + e^-(g) \rightarrow X^-(g) \Delta H_{eg}^\circ = \text{-300 kJ mol}^{-1}$

$M(s) + \dfrac{1}{2} X_2(g) \rightarrow M^+ X^-(s) \Delta H_f^\circ = -400 \text{ kJ mol}^{-1}$
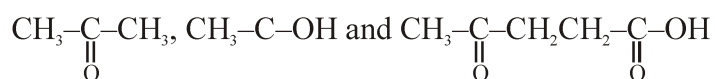
[Given : $M^+ X^-$ is a pure ionic compound and X forms a diatomic molecule X_2 in gaseous state]

Ans. Official answer NTA (200)

Sol.

Question ID : 656445449

75. A compound 'X' absorbs 2 moles of hydrogen and 'X' upon oxidation with $KMnO_4 | H|^+$ gives

$$CH_3-\underset{\underset{O}{\|}}{C}-CH_3, \; CH_3-\underset{\underset{O}{\|}}{C}-OH \text{ and } CH_3-\underset{\underset{O}{\|}}{C}-CH_2CH_2-\underset{\underset{O}{\|}}{C}-OH$$

The total number of σ bonds present in the compound 'X' is _____.

Ans. Official answer NTA (27)

Sol.