JEE Main January 2025

Question Paper With Text Solution

29 January | Shift-1

CHEMISTRY

MATRIX

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

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JEE MAIN JANUARY 2025 | 29TH JANUARY SHIFT-1

SECTION – A

Question ID : 656445585

51. Given below are two statements :

Statement (I): The radii of isoelectronic species increases in the order.

$$Mg^{2+} < Na^{+} < F^{-} < O^{2-}$$

Statement (II) : The magnitude of electron gain enthalpy of halogen decreases in the order.

$$Cl > F > Br > I$$

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

(1) Both Statement I and Statement II are incorrect

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

(3) Both Statement I and Statement II are correct

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

Ans. Official answer NTA (3)

Sol.

Question ID : 656445580

52. At temperature T, compound $AB_{2(g)}$ dissociates as $AB_{2(g)} \rightleftharpoons AB_{(g)} + \frac{1}{2}B_{2(g)}$ having degree of dissociation x (small compared to unity). The correct expression for x in terms of K_p and p is :

(1) $\sqrt{K_p}$ (2) $\sqrt[3]{\frac{2K_p^2}{p}}$ (3) $\sqrt[3]{\frac{2K_p}{p}}$ (4) $\sqrt[4]{\frac{2K_p}{p}}$

Ans. Official answer NTA (2)

Sol.

Question ID : 656445577

53. If a_0 is denoted as the Bohr radius of hydrogen atom, then what is the de-Broglie wavelength (λ) of the electron present in the second orbit of hydrogen atom ? [n : any integer]

(1) $\frac{4\pi a_0}{n}$ (2) $\frac{8\pi a_0}{n}$ (3) $\frac{2a_0}{n\pi}$ (4) $\frac{4n}{\pi a_0}$

Ans. Official answer NTA (2)

Sol.

Question ID : 656445587

54. Match List - I with List - II.

List-I (Complex)	List-II (Hybridisation & Magnetic characters)
(A) $[MnBr_4]^{2-}$	(I) d^2sp^3 & diamagnetic
(B) $[FeF_6]^{3-}$	(II) sp^3d^2 & paramagnetic
(C) $[Co(C_2O_4)_3]^{3-}$	(III) sp^3 & diamagnetic
(D) $[Ni(CO)_4]$	(IV) sp^3 & paramagnetic

Choose the correct answer from the options given below :

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

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

Ans. Official answer NTA (3)

Sol.

Question ID : 656445583

55. The reaction $A_2 + B_2 \rightarrow 2AB$ follows the mechanism

$$A_2 \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} A + A\,(\text{fast})$$

$$A + B_2 \overset{k_2}{\rightleftharpoons} AB + B\,(\text{slow})$$

$A + B \rightarrow AB$ (fast)

The overall order of the reaction is :

(1) 3 (2) 2.5 (3) 1.5 (4) 2

Ans. Official answer NTA (3)

Sol.

Question ID : 656445581

56. The molar conductivity of a weak electrolyte when plotted against the square root of its concentration, which of the following is expected to be observed :

(1) Molar conductivity decreases sharply with increase in concentration.

(2) Molar conductivity increases sharply with increase in concentration.

(3) A small increase in molar conductivity is observed at infinite dilution.

(4) A small decrease in molar conductivity is observed at infinite dilution.

Ans. Official answer NTA (1)

Sol.

Question ID : 656445586

57. The standard reduction potential values of some of the p-block ions are given below. Predict the one with the strongest oxidising capacity :

(1) $E^{\Theta}_{Tl^{3+}/Tl} = +1.26V$

(2) $E^{\Theta}_{Pb^{4+}/Pb^{2+}} = +1.67V$

(3) $E^{\Theta}_{Sn^{4+}/Sn^{2+}} = +1.15V$

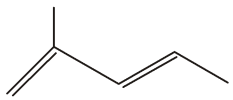
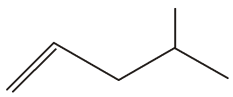
(4) $E^{\Theta}_{Al^{3+}/Al} = -1.66V$

Ans. Official answer NTA (2)

Sol.

Question ID : 656445592

58. Match List - I with List - II.

List-I (Structure)	List-II (IUPAC Name)
(A) $H_3C-CH_2-\underset{\underset{C_2H_5}{\vert}}{CH}-CH_2-\underset{\underset{CH_3}{\vert}}{CH}-C_2H_5$	(I) 4-Methylpent-1-ene
(B) $(CH_3)_2C\,(C_3H_7)_2$	(II) 3-Ethyl-5-methylheptane
(C) 	(III) 4,4-Dimethylheptane
(D) 	(IV) 2-Methyl-1,3-pentadiene

Choose the correct answer from the options given below :

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

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

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

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

Ans. Official answer NTA (2)

Sol.

Question ID : 656445579

59. 1.24 g of AX_2 (molar mass 124 g mol^{-1}) is dissolved in 1 kg of water to form a solution with boiling point of 100.0156° C, while 25.4 g of AY_2 (molar mass 250 g mol^{-1}) in 2 kg of water constitutes a solution with a boiling point of 100.0260° C.

$K_b(H_2O) = 0.52$ K kg mol^{-1}

Which of the following is correct :

(1) AX_2 and AY_2 (both) are fully ionised.

(2) AX_2 and AY_2 (both) are completely unionised.

(3) AX_2 is completely unionised while AY_2 is fully ionised.

(4) AX_2 is fully ionised while AY_2 is completely unionised.

Ans. Official answer NTA (4)

Sol.

Question ID : 656445578

60. 500 J of energy is transferred as heat to 0.5 mol of Argon gas at 298 K and 1.00 atm. The final temperature and the change in internal energy respectively are :

Given : R = 8.3 J K^{-1} mol^{-1} :

(1) 348 K and 300 J

(2) 378 K and 500 J

(3) 378 K and 300 J

(4) 368 K and 500 J

Ans.

Ans. Official answer NTA (2)

Question ID : 656445591

61. Total number of nucleophiles from the following is :

$NH_3, PhSH, (H_3C)_2S, H_2C=CH_2, \overset{\ominus}{O}H, H_3O^+, (CH_3)_2CO,$ 

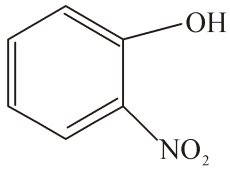
(1) 5 (2) 7 (3) 6 (4) 4

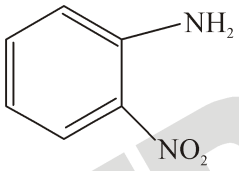
Ans. Official answer NTA (1)

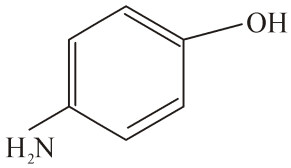
Sol.

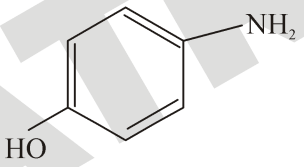
Question ID : 656445590

62. The steam volatile compounds among the following are :

(A) 

(B) 

(C) 

(D) 

Choose the correct answer from the options given below :

(1) (B) and (D) Only (2) (A) and (C) Only

(3) (A), (B) and (C) Only (4) (A) and (B) Only

Ans. Official answer NTA (4)

Sol.

Question ID : 656445589

63. The correct option with order of melting points of the pairs (Mn, Fe),(Tc, Ru) and (Re, Os) is :

(1) Mn < Fe, Tc < Ru and Re < Os (2) Fe < Mn, Ru < Tc and Os < Re

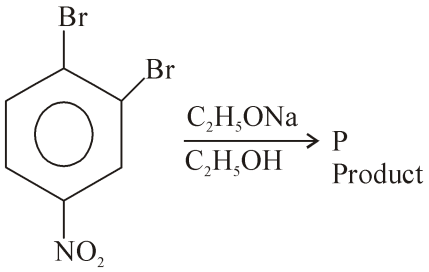
(3) Mn < Fe, Tc < Ru and Os < Re (4) Fe < Mn, Ru < Tc and Re < Os

Ans. Official answer NTA (3)

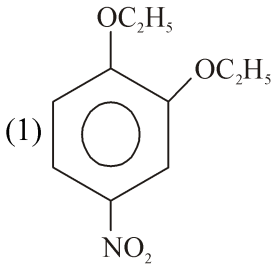
Sol.

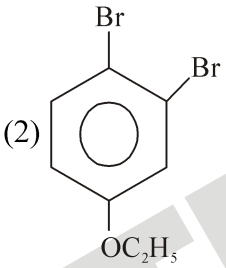
Question ID : 656445593

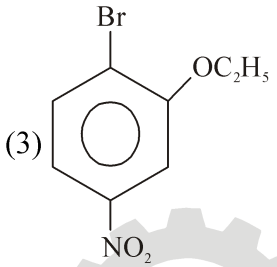
64. In the following substitution reaction :

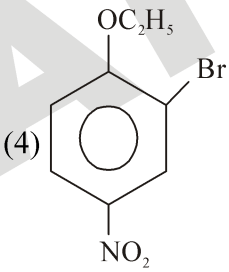


product ' P ' formed is :

(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (4)

Sol.

Question ID : 656445576

65. Choose the correct statements.

(A) Weight of a substance is the amount of matter present in it.
(B) Mass is the force exerted by gravity on an object.
(C) Volume is the amount of space occupied by a substance.
(D) Temperature below 0° C are possible in Celsius scale, but in Kelvin scale negative temperature is not possible.
(E) Precision refers to the closeness of various measurements for the same quantity.

Choose the correct answer from the options given below :

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

Ans. Official answer NTA (2)

Sol.

Question ID : 656445588

66. The correct increasing order of stability of the complexes based on Δ_0 value is :

I. $[Mn(CN)_6]^{3-}$ II. $[Co(CN)_6]^{4-}$ III. $[Fe(CN)_6]^{4-}$ IV. $[Fe(CN)_6]^{3-}$

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

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

Ans. Official answer NTA (1)

Sol.

Question ID : 656445584

67. An element 'E' has the ionisation enthalpy value of 374 kJ mol^{-1}. 'E' reacts with elements A, B, C and D with electron gain enthalpy values of –328,–349,–325 and –295 kJ mol^{-1}, respectively. The correct order of the products EA, EB, EC and ED in terms of ionic character is :

(1) EB > EA > EC > ED (2) EA> EB > EC > ED

(3) ED> EC > EA > EB (4) ED > EC > EB > EA

Ans. Official answer NTA (1)

Sol.

Question ID : 656445582

68. For a $Mg|Mg^{2+}(aq)||Ag^{+}(aq)|Ag$ the correct Nernst Equation is :

(1) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Ag^{+}]}{[Mg^{2+}]}$ (2) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Ag^{+}]^2}{[Mg^{2+}]}$

(3) $E_{cell} = E^{o}_{cell} + \frac{RT}{2F}\ln\frac{[Ag^{+}]^2}{[Mg^{2+}]}$ (4) $E_{cell} = E^{o}_{cell} - \frac{RT}{2F}\ln\frac{[Mg^{2+}]}{[Ag^{+}]}$

Ans. Official answer NTA (3)

Sol.

Question ID : 656445595

69. Match List - I with List - II.

List-I (Carbohydrate)	List-II (Linkage Source)
(A) Amylose	(I) β–C_1 – C_4, plant
(B) Cellulose	(II) α–C_1 – C_4, animal
(C) Glycogen	(III) α–C_1 – C_4, α–C_1 – C_6, plant
(D) Amylopectin :	(IV) α–C_1 – C_4, plant

Choose the correct answer from the options given below :

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

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

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

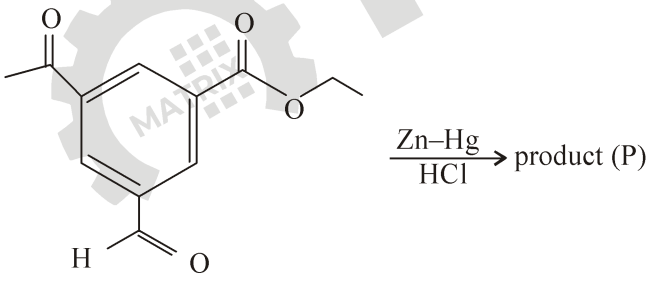
(4) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

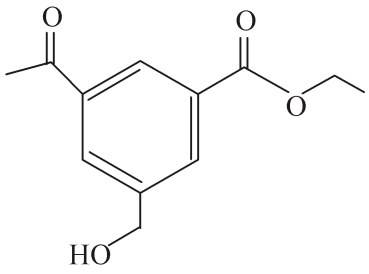
Ans. Official answer NTA (3)

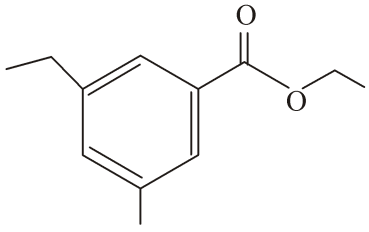
Sol.

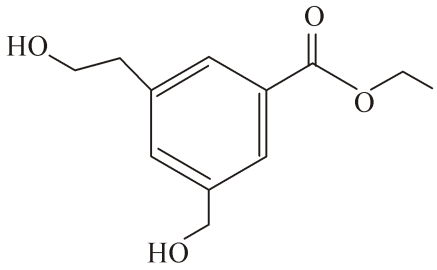
Question ID : 656445594

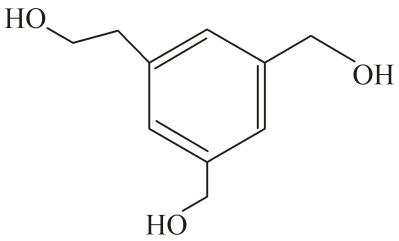
70. The product (P) formed in the following reaction is :



(1) 

(2) 

(3) 

(4) 

Ans. Official answer NTA (2)

Sol.

SECTION – B

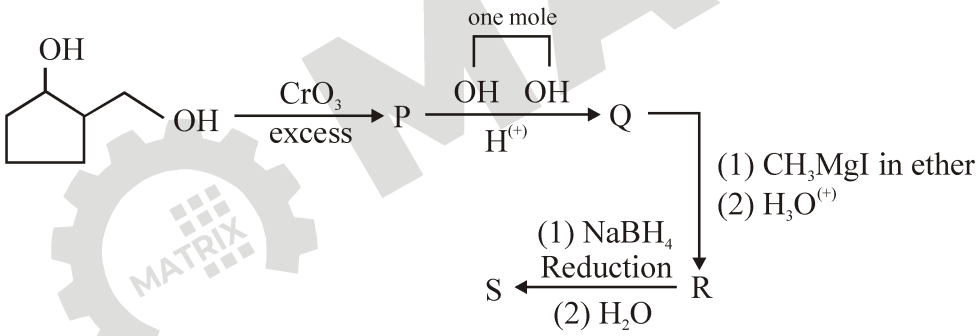
Question ID : 656445599

71. The sum of sigma (σ) and pi (π) bonds in Hex-1,3-dien-5-yne is _____.

Ans. Official answer NTA (15)

Sol.

Question ID : 656445598

72. 

0.1 mole of compound 'S' will weigh _____ g.

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

Ans. Official answer NTA (13)

Sol.

Question ID : 656445596

73. If A_2B is 30% ionised in an aqueous solution, then the value of van't Hoff factor (i) is_____ $\times 10^{-1}$.

Ans. Official answer NTA (16)

Sol.

Question ID : 656445597

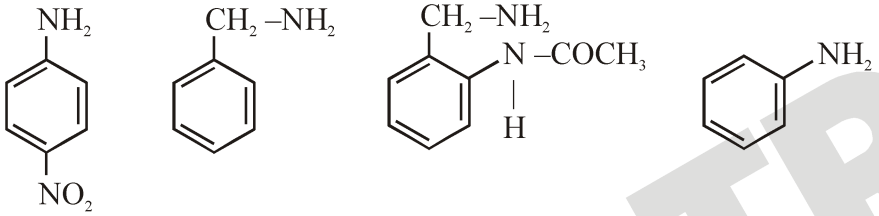
74. The molar mass of the water insoluble product formed from the fusion of chromite ore $\left(FeCr_2O_4\right)$ with Na_2CO_3 in presence of O_2 is _____ g mol^{-1}.

Ans. Official answer NTA (160)

Sol.

Question ID : 656445600

75. Given below are some nitrogen containing compounds



Each of them is treated with HCl separately. 1.0 g of the most basic compound will consume Na_2CO_3 ... mg of HCl .

(Given molar mass in $gmol^{-1}$ C : 12, H : 1, O : 16, Cl : 35.5)

Ans. Official answer NTA (341)

Sol.