JEE Main January 2024

Question Paper With Text Solution

30 January | Shift-2

CHEMISTRY

MATRIX

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

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1. The correct stability order of carbocations is

(1) $(CH_3)_3\overset{+}{C} > (CH_3)_2\overset{+}{C}H > CH_3-\overset{+}{C}H_2 > \overset{+}{C}H_3$

(2) $\overset{+}{C}H_3 > (CH_3)_2\overset{+}{C}H > CH_3-\overset{+}{C}H_2 > (CH_3)_3\overset{+}{C}$

(3) $(CH_3)_3\overset{+}{C} > CH_3-\overset{+}{C}H_2 > (CH_3)_2\overset{+}{C}H > \overset{+}{C}H_3$

(4) $\overset{+}{C}H_3 > CH_3-\overset{+}{C}H_2 > CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle +}{C}}H > (CH_3)_3\overset{+}{C}$

Question ID: 4058591087

Ans. Official Answer NTA (1)

Sol.

2. Alkaline oxidative fusion of MnO_2 gives "A" which on electrolytic oxidation in alkaline solution produces B. A and B respectively are

(1) Mn_2O_7 and MnO_4^-

(2) MnO_4^{2-} and MnO_4^-

(3) MnO_4^{2-} and Mn_2O_7

(4) Mn_2O_3 and MnO_4^{2-}

Question ID: 4058591083

Ans. Official Answer NTA (2)

Sol.

3. IUPAC name of following compound is

$$CH_3-\underset{\displaystyle NH_2}{\underset{|}{CH}}-CH_2-CN$$

(1) 3-Aminopropanenitrile

(2) 3-Aminobutanenitrle

(3) 2-Aminopentanenitrile

(4) 2-Aminobutanenitrile

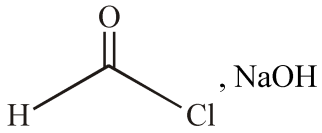
Question ID: 4058591088

Ans. Official Answer NTA (2)

Sol.

64. Salicylaldehyde is synthesized from phenol, when reacted with

(1) $HCCl_3$, NaOH

(2)  , NaOH

(3) CCl_4, NaOH

(4) CO_2, NaOH

Question ID: 4058591090

Ans. Official Answer NTA (1)

Sol.

5. The solution from the following with highest depression in freezing point/lowest freezing point is

(1) 180 g of acetic acid dissolved in benzene

(2) 180 g of benzoic acid dissolved in benzene

(3)180 g of glucose dissolved in water

(4) 180 g of acetic acid dissolved in water

Question ID: 4058591078

Ans. Official Answer NTA (4)

Sol.

6. The coordination geometry around the manganese in decacarbonyldimangauese (0) is

(1) Octahedral

(2) Trigonal bipyramidal

(3) Square pyramidal

(4) Square planar

Question ID: 4058591085

Ans. Official Answer NTA (1)

Sol.

7. Reduction potential of ions are given below :

ClO_4^-	IO_4^-	BrO_4^-
$E° = 1.19V$	$E° = 1.65V$	$E° = 1.74V$

The correct order of their oxidising power is :

(1) $ClO_4^- > IO_4^- > BrO_4^-$

(2) $BrO_4^- > ClO_4^- > IO_4^-$

(3) $BrO_4^- > IO_4^- > ClO_4^-$

(4) $IO_4^- > BrO_4^- > ClO_4^-$

Question ID: 4058591079

Ans. Official Answer NTA (3)

Sol.

8. Given below are two statements:

Statement - I: High concentration of strong nucleophilic reagent with secondary alkyl halides which do not have bulky substituents will follow S_N^2 mechanism.

Statement - II: A secondary alkyl halide when treated with a large excess of ethanol follows S_N^1 mechanism.

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

(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.

Question ID: 4058591089

Ans. Official Answer NTA (2)

Sol.

9. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R:

Assertion A: H_2Te is more acidic than H_2S.

Reason R: Bond dissociation enthalpy of H_2Te is lower than H_2S.

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

(1) Both A and R are true but R is NOT the correct explanation of A.

(2) Both A and R are true and R is the correct explanation of A.

(3) A is false but R is true.

(4) A is true but R is false.

Question ID: 4058591082

Ans. Official Answer NTA (2)

Sol.

10. A and B formed in the following reactions are:

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

$A + 2HCl + 2H_2O_2 \rightarrow B + 3H_2O$

(1) $A = Na_2Cr_2O_7, B = CrO_5$

(2) $A = Na_2CrO_4, B = CrO_5$

(3) $A = Na_2Cr_2O_4, B = CrO_4$

(4) $A = Na_2Cr_2O_7, B = CrO_3$

Question ID: 4058591094

Ans. Official Answer NTA (2)

Sol.

11. Choose the correct statements about the hydrides of group 15 elements.

A. The stability of the hydrides decreases in the order $NH_3 > PH_3 > AsH_3 > SbH_3 > BiH_3$.

B. The reducing ability of the hydride increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$.

C. Among the hydrides, NH_3 is strong reducing agent while BiH_3 is mild reducing agent.

D. The basicity of the hydrides increases in the order $NH_3 < PH_3 < AsH_3 < SbH_3 < BiH_3$.

Choose the most appropriate from the options given below:

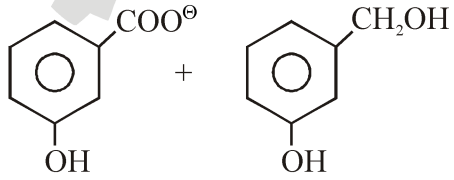
(1) A and B only (2) C and D only (3) B and C only (4) A and D only

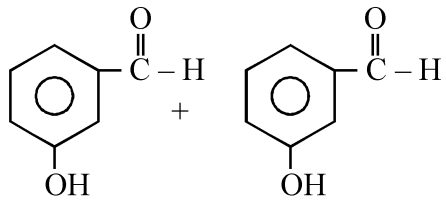
Question ID: 4058591081

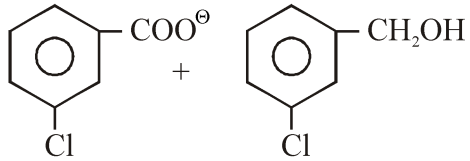
Ans. Official Answer NTA (1)

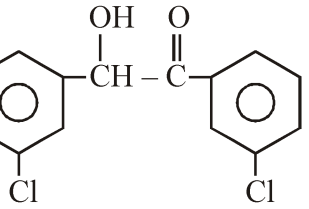
Sol.

12. m-chlorobenzaldehyde on treatment with $50\%KOH$ solution yields

(1) 

(2) 

(3) 

(4) 

Question ID: 4058591092

Ans. Official Answer NTA (3)

Sol.

13. Given below are two statements:

Statement - I: Along the period, the chemical reactivity of the elements gradually increases from group 1 to group 18.

Statement - II: The nature of oxides formed by group 1 elements is basic while that of group 17 elements is acidic.

In the light of the above statements, choose the most appropriate 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 I is true

(4) Both Statement I and Statement II are False

Question ID: 4058591080

Ans. Official Answer NTA (3)

Sol.

14. Which among the following purification methods is based on the principle of "Solubility" in two different solvents?

(1) Differential Extraction

(2) Column Chromatography

(3) Sublimation

(4) Distillation

Question ID: 4058591086

Ans. Official Answer NTA (1)

Sol.

15. The molecule / ion with square pyramidal shape is

(1) $[Ni(CN)_4]^{2-}$

(2) BrF_5

(3) PCl_5

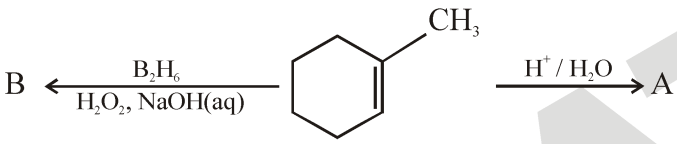
(4) PF_5

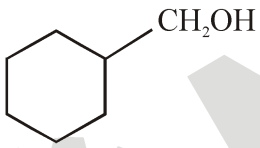
Question ID: 4058591077

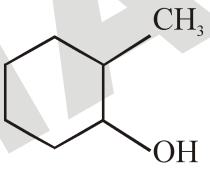
Ans. Official Answer NTA (2)

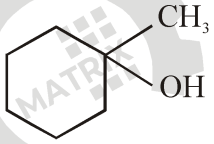
Sol.

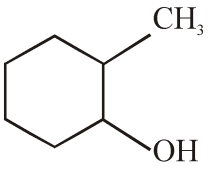
16. Products A and B formed in the following set of reactions are

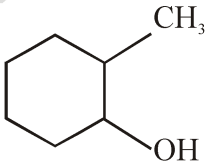


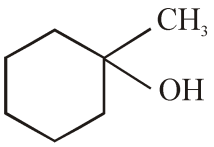
(1) A = 

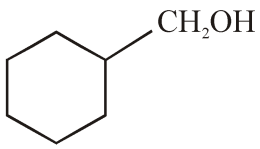
B = 

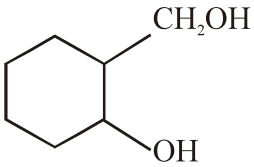
(2) A = 

B = 

(3) A = 

B = 

(4) A = 

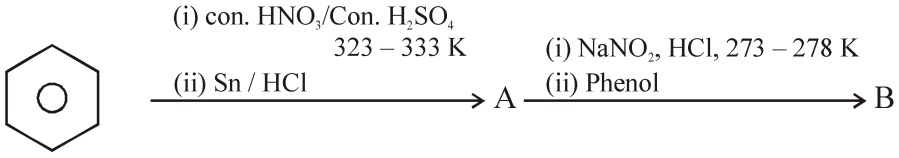
B = 

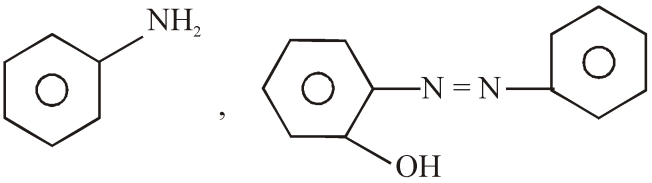
Question ID: 4058591091

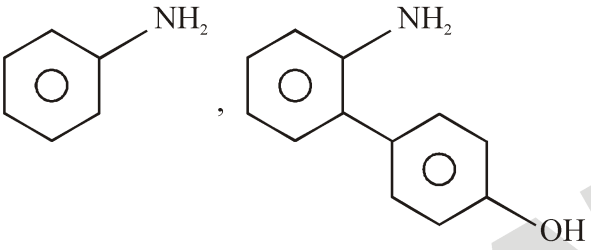
Ans. Official Answer NTA (2)

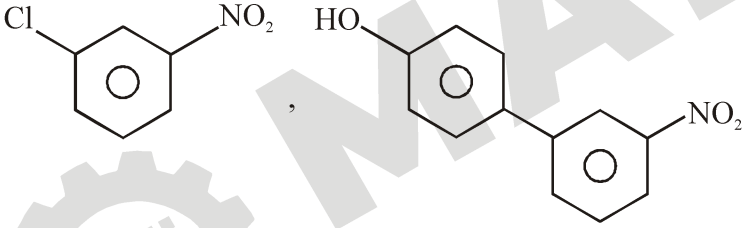
Sol.

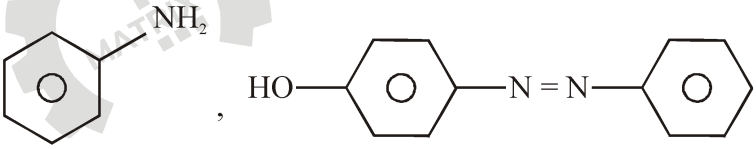
17. The products A and B formed in the following reaction scheme are respectively



(1) 

(2) 

(3) 

(4) 

Question ID: 4058591093

Ans. Official Answer NTA (4)

Sol.

18. If a substance 'A' dissolves in solution of a mixture of 'B' and 'C' with their respective number of moles as n_A, n_B and n_C, Mole fraction of C in the solution is

(1) $\frac{n_C}{n_A - n_B - n_C}$

(2) $\frac{n_C}{n_A \times n_B \times n_C}$

(3) $\frac{n_C}{n_A + n_B + n_C}$

(4) $\frac{n_B}{n_A + n_B}$

Question ID: 4058591075

Ans. Official Answer NTA (3)

Sol.

19. Given below are two statements:

Statement - I: Since Fluorine is more electronegative than nitrogen, the net dipole moment of NF_3 is greater than NH_3.

Statement - II: In NH_3, the orbital dipole due to lone pair and the dipole moment of NH bonds are in opposite direction, but in NF_3 the orbital dipole due to lone pair and dipole moments of N-F bonds are in same direction.

In the light of the above statements, choose the most appropriate 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.

Question ID: 4058591076

Ans. Official Answer NTA (4)

Sol.

20. The orange colour of $K_2Cr_2O_7$ and purple colour of $KMnO_4$ is due to

(1) $d \rightarrow d$ transitions in $KMnO_4$ and charge transfer transitions in $K_2Cr_2O_7$

(2) $d \rightarrow d$ transitions in $K_2Cr_2O_7$ and charge transfer transitions in $KMnO_4$.

(3) Charge transfer transition in both.

(4) $d \rightarrow d$ transitions in both

Question ID: 4058591084

Ans. Official Answer NTA (3)

Sol.

21. 2-chlorobutane + $Cl_2 \rightarrow C_4H_8Cl_2$ (isomers)

Total number of optically active isomers shown by $C_4H_8Cl_2$, obtained in the above reaction is _____.

Given --

Question ID: 4058591102

Ans. Official Answer NTA (3)

Answer by Matrix is (6)

Sol.

22. Number of metal ions characterized by flame test among the following is

$Sr^{2+}, Ba^{2+}, Ca^{2+}, Cu^{2+}, Zn^{2+}, Co^{2+}, Fe^{2+}$

Question ID: 4058591104

Ans. Official Answer NTA (4)

Sol.

23. The pH of an aqueous solution containing 1 M benzoic acid $(pK_a = 4.20)$ and 1 M sodium benzoate is 4.5. The volume of benzoic acid solution in $300\,mL$ of this buffer solution is mL. (given : $\log 2 = 0.3$)

Given --

Question ID: 4058591097

Ans. Official Answer NTA (100)

Sol.

24. Two reactions are given below:

$$2Fe_{(s)} + \frac{3}{2}O_{2(g)} \rightarrow Fe_2O_{3(s)}, \Delta H^\circ = -822\,kJ/mol$$

$$C_{(s)} + \frac{1}{2}O_{2(g)} \rightarrow CO_{(g)}, \Delta H^\circ = -110\,kJ/mol$$

Then enthalpy change for following reaction $3C_{(s)} + Fe_2O_{3(s)} \rightarrow 2Fe_{(s)} + 3CO_{(g)}$ is _____ kJ/mol.

Question ID: 4058591096

Ans. Official Answer NTA (492)

Sol.

25. The total number of correct statements, regarding the nucleic acids is

A. RNA is regarded as the reserve of genetic information

B. DNA molecule self-duplicates during cell division

C. DNA synthesizes proteins in the cell

D. The message for the synthesis of particular proteins is present in DNA

E. Identical DNA strands are transferred to daughter cells.

Question ID: 4058591103

Ans. Official Answer NTA (3)

Sol.

26. Number of spectral lines obtained in He^+ spectra, when an electron makes transition from fifth excited state to first excited state will be

Question ID: 4058591095

Ans. Official Answer NTA (10)

Sol.

27. Total number of species from the following which can undergo disproportionation reaction is _____.

$H_2O_2, ClO_3^-, P_4, Cl_2, Ag, Cu^{+1}, F_2, NO_2, K^+$

Question ID: 4058591098

Ans. Official Answer NTA (6)

Sol.

28. NO_2 required for a reaction is produced by decomposition of N_2O_5 in CCl_4 as by equation

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

The initial concetration. of N_2O_5 is $3\,mol\,L^{-1}$ and it is $2.75\,mol\,L^{-1}$ after 30 minutes.

The rate of formation of NO_2 is $x \times 10^{-3}\,mol\,L^{-1}\,min^{-1}$, value of x is (nearest integer)

Question ID: 4058591099

Ans. Official Answer NTA (17)

Sol.

29. Number of complexes which show optical isomerism among the following is

cis- $[Cr(ox)_2Cl_2]^{3-}$, $[Co(en)_3]^{3+}$, cis- $[Pt(en)_2Cl_2]^{2+}$, cis- $[Co(en)_2Cl_2]^+$,

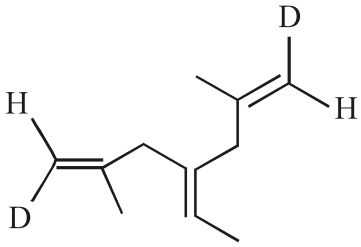
trans- $-[Pt(en)_2Cl_2]^{2+}$, trans- $[Cr(ox)_2Cl_2]^{3-}$

Question ID: 4058591100

Ans. Official Answer NTA (4)

Sol.

30. Number. of geometrical isomers possible for the given structure is/are



Question ID: 4058591101

Ans. Official Answer NTA (4)

Sol.