JEE Main January 2024

Question Paper With Text Solution

31 January | Shift-2

CHEMISTRY

1. Choose the correct statements from the following

   A. All group 16 elements form oxides of general formula EO_2 and EO_3, where E = S, Se, Te and Po. Both the types of oxides are acidic in nature.

   B. TeO_2 is an oxidising agent while SO_2 is reducing in nature.

   C. The reducing property decreases from H_2S to H_2Te down the group.

   D. The ozone molecule contains five lone pairs of electrons.

   Choose the correct answer from the options given below:

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

   Question ID : 4058591262

   Ans. Official Answer NTA (1)

2. $A_{(g)} \rightleftharpoons B_{(g)} + \dfrac{C}{2}(g)$ The correct relationship between K_P, α and equilibrium pressure P is

   (1) $K_P = \dfrac{\alpha^{1/2}P^{3/2}}{(2+\alpha)^{3/2}}$ (2) $K_P = \dfrac{\alpha^{1/2}P^{1/2}}{(2+\alpha)^{1/2}}$

   (3) $K_P = \dfrac{\alpha^{1/2}P^{1/2}}{(2+\alpha)^{3/2}}$ (4) $K_P = \dfrac{\alpha^{3/2}P^{1/2}}{(2+\alpha)^{1/2}(1-\alpha)}$

   Question ID : 4058591258

   Ans. Official Answer NTA (4)

3. A sample of $CaCO_3$ and $MgCO_3$ weighed 2.21 g is ignited to constant weight of 1.152 g. The composition of mixture is :

   (Given molar mass in g^{-1} $CaCO_3$: 100, $MgCO_3$: 84)

   (1) 1.187 g $CaCO_3$ + 1.187 g $MgCO_3$

   (2) 1.023 g $CaCO_3$ + 1.187 g $MgCO_3$

   (3) 1.187 g $CaCO_3$ + 1.023 g $MgCO_3$

   (4) 1.023 g $CaCO_3$ + 1.023 g $MgCO_3$

   Question ID : 4058591255

   Ans. Official Answer NTA (3)

4. Select the option with correct property -

   (1) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both Diamagnetic

   (2) $[NiCl_4]^{2-}$ Diamagnetic, $[Ni(CO)_4]$ Paramagnetic

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(3) $[Ni(CO)_4]$ Diamagnetic, $[NiCl_4]^{2-}$ Paramagnetic

(4) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both Paramagnetic

Question ID : 4058591264

Ans.   Official Answer NTA (3)

5.   Given below are two statements :

Statement I : Aniline reacts with con. H_2SO_4, followed by heating at 453-473 K gives p-aminobenzene sulphonic acid, which gives blood red colour in the 'Lassaigne's test'.

Statement II : In Friedel - Craft's alkylation and acylation reactions, aniline forms salt with the $AlCl_3$ catalyst. Due to this, nitrogen of aniline aquires a positive charge and acts as deactivating group.

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 true

(3) Both statement I and statement II are false

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

Question ID : 4058591273

Ans.   Official Answer NTA (2)

6.   Consider the following elements.

Group $\downarrow$ A' B' $\rightarrow$ Period
     C' D'

Which of the following is/are true about A', B , C' and D' ?

A. Order of atomic radii: B' < A' < D' < C'

B. Order of metallic character: B' < A' < D' < C'

C. Size of the element: D' < C' < B' < A'

D. Order of ionic radii: B'^{+} < A'^{+} < D'^{+} < C'^{+}

Choose the correct answer from the options given below :

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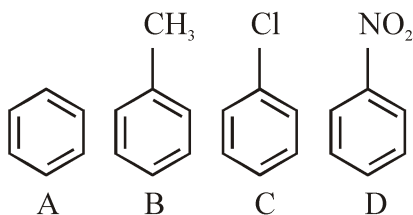
(3) A, B and D only   (4) B, C and D only

Question ID : 4058591260

Ans.   Official Answer NTA (3)

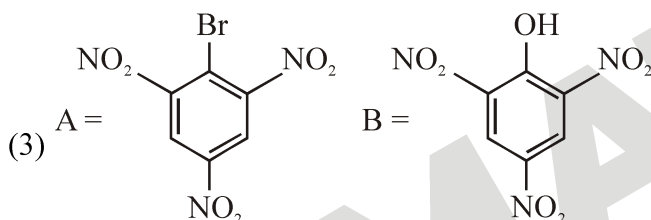**MATRIX JEE ACADEMY**
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7. The correct order of reactivity in electrophilic substitution reaction of the following compounds is :

(1) B > C > A > D   (2) A > B > C > D   (3) B > A > C > D   (4) D > C > B > A

Question ID : 4058591267

Ans. Official Answer NTA (1)

Answer by Matrix is (3)

8. Given below are two statements:

Statement I : S_8 solid undergoes disproportionation reaction under alkaline conditions to form S^{2-} and $S_2O_3^{2-}$.

Statement II : ClO_4^- can undergo disproportionation reaction under acidic condition.

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) Both statement I and statement II are correct

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

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

Question ID : 4058591259

Ans. Official Answer NTA (4)

9. Choose the correct statements from the following

A. Mn_2O_7 is an oil at room temperature

B. V_2O_4 reacts with acid to give VO_2^{2+}

C. CrO is a basic oxide

D. V_2O_5 does not react with acid

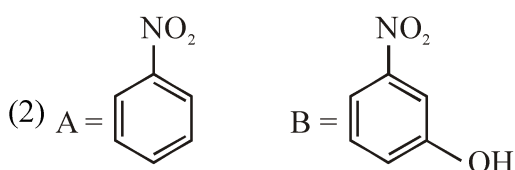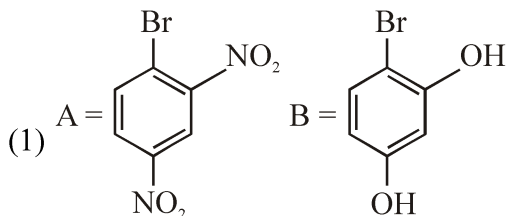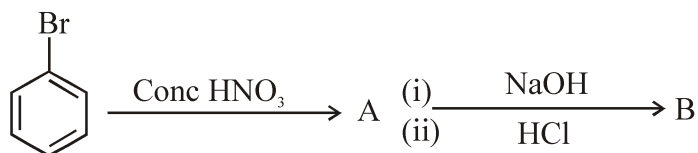Choose the correct answer from the options given below :

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

Question ID : 4058591263

Ans. Official Answer NTA (2)

10. Identify A and B in the following reaction sequence.

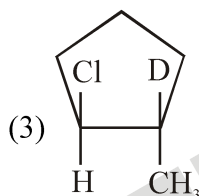**MATRIX JEE ACADEMY**
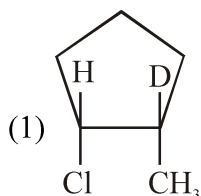**Office : Piprali Road, Sikar (Raj.) | Ph. 01572-241911**
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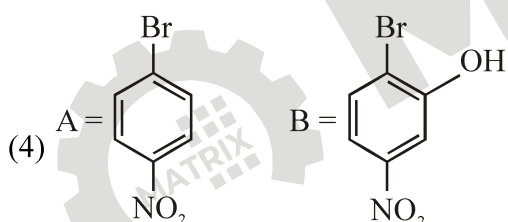
Question ID : 4058591270

Ans.   Official Answer NTA (3)

11.   The fragrance of flowers is due to the presence of some steam volatile organic compounds called essential oils.

These are generally insoluble in water at room temperature but are miscible with water vapour in vapour phase.

A suitable method for the extraction of these oils from the flowers is -

(1) steam distillation

(2) crystallisation

(3) distillation under reduced pressure

(4) distillation

Question ID : 4058591266

Ans.   Official Answer NTA (1)

12.   Major product of the following reaction is -

$\xrightarrow{\text{D} - \text{Cl}}$?

(1) H D / Cl CH₃

(2) D CH₃ / H Cl
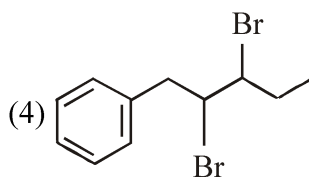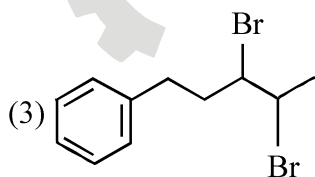
(3) Cl D / H CH₃

(4) D Cl / H CH₃
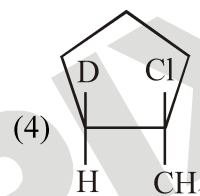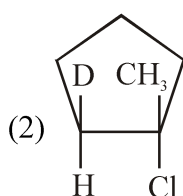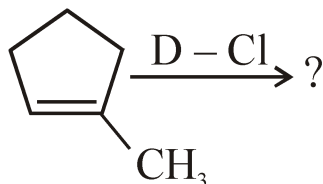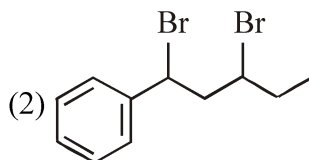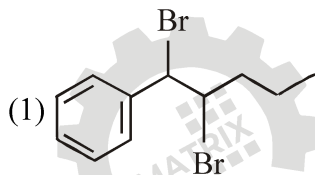
Question ID :

Ans.   Official Answer NTA (2)

Answer by Matrix is (2 & 4)

13.   Identify structure of 2,3-dibromo-1-phenylpentane.

(1)

(2)

(3)

(4)

Question ID :

Ans.   Official Answer NTA (4)

14.   The four quantum numbers for the electron in the outer most orbital of potassium (atomic no. 19) are

(1) $n = 4, l = 0, m = 0, s = +\dfrac{1}{2}$

(2) $n = 3, l = 0, m = 1, s = +\dfrac{1}{2}$

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(3) $n = 4, l = 2, m = -1, s = +\dfrac{1}{2}$

(4) $n = 2, l = 0, m = 0, s = +\dfrac{1}{2}$

Question ID : 4058591256

Ans.   Official Answer NTA (1)

15.   Given below are two statements :

Statement I : Group 13 trivalent halides get easily hydrolyzed by water due to their covalent nature.

Statement II : $AlCl_3$ upon hydrolysis in acidified aqueous solution forms octahedral
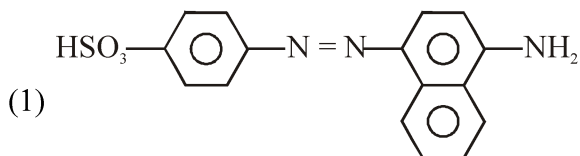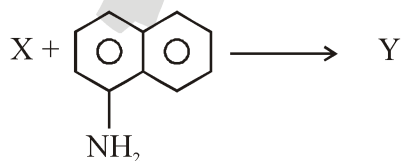
$\left[Al\left(H_2O \right)_6 \right]^{3+}$ ion.

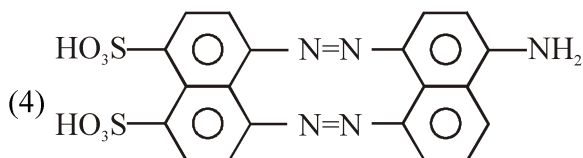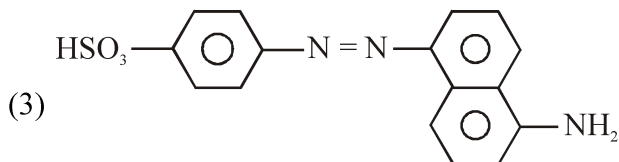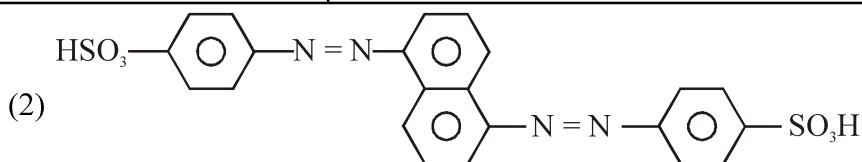In the light of the above statements, choose the correct answer from the options given below :

(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

Question ID : 4058591261

Ans.   Official Answer NTA (3)

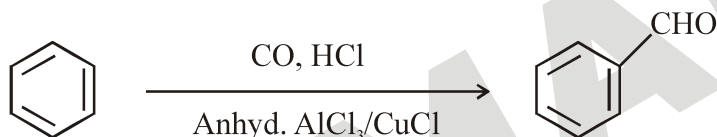16.   The azo-dye (Y) formed in the following reactions is

$Sulphanilic acid + NaNO_2 + CH_3COOH \rightarrow X.$

(2)
$$HSO_3 - \text{[benzene ring]} - N = N - \text{[naphthalene ring]} - N = N - \text{[benzene ring]} - SO_3H$$

(3)
$$HSO_3 - \text{[benzene ring]} - N = N - \text{[naphthalene ring]} - NH_2$$

(4)
$$HO_3S - \text{[naphthalene with]} - N=N - \text{[naphthalene]} - NH_2$$
$$HO_3S - \text{[ring]} - N=N$$

Question ID : 4058591274

Ans. Official Answer NTA (1)

17. Identify the name reaction.

$$\text{[benzene]} \xrightarrow[\text{Anhyd. AlCl}_3/\text{CuCl}]{\text{CO, HCl}} \text{[benzaldehyde with CHO]}$$
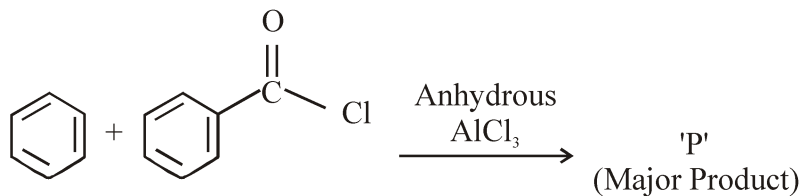
(1) Etard Reaction
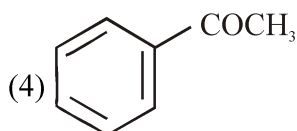
(2) Rosenmund Reduction

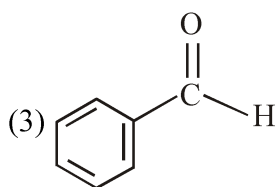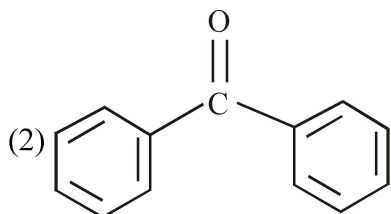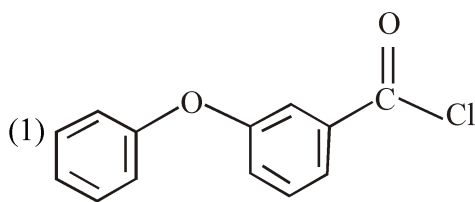(3) Gatterman - Koch Reaction

(4) Stephen Reaction

Question ID : 4058591272

Ans. Official Answer NTA (3)

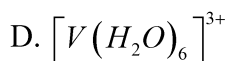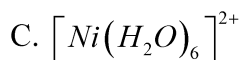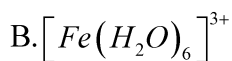18. Identify major product 'P' formed in the following reaction.

$$\text{[benzene]} + \text{[benzoyl chloride, } C_6H_5COCl\text{]} \xrightarrow[\text{AlCl}_3]{\text{Anhydrous}} \text{'P'} \\ \text{(Major Product)}$$

(1)

(2)

(3)

(4)

Question ID : 4058591271

Ans.   Official Answer NTA (2)

19.   Match List I with List II

LIST I

(Complex ion)

A. $\left[Cr(H_2O)_6 \right]^{3+}$

B. $\left[Fe(H_2O)_6 \right]^{3+}$

C. $\left[Ni(H_2O)_6 \right]^{2+}$

D. $\left[V(H_2O)_6 \right]^{3+}$
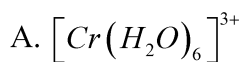
LIST I

(Electronic Configuration)

I. $t_{2g}^2 e_g^0$

II. $t_{2g}^3 e_g^0$

III. $t_{2g}^3 e_g^2$

IV. $t_{2g}^6 e_g^2$
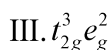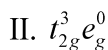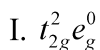
Choose the correct answer from the options given below:

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

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

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

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

Question ID : 4058591265

Ans.   Official Answer NTA (2)

20.   Which of the following is least ionic?
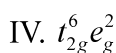
(1) $CoCl_2$

(2) $BaCl_2$

(3) KCl

(4) AgCl

Question ID : 4058591257

Ans.   Official Answer NTA (4)

21.   A compound (x) with molar mass 108 g mol^{-1} undergoes acetylation to give product with molar mass 192 g mol^{-1}. The number of amino groups in the compund (x) is

Question ID : 4058591282

Ans.   Official Answer NTA (2)

22.   r = k[A] for a reaction, 50 % of A is decomposed in 120 minutes. The time taken for 90 % decomposition of A is minutes.

Question ID : 4058591279

Ans.   Official Answer NTA (399)

23.   The molarity of 1 L orthophosphoric acid (H_3PO_4) having 70% purity by weight (specific gravity 1.54 g cm^{-3}) is ————— M.

(Molar mass of $H_3PO_4 = 98\,g\,mol^{-1}$)

Question ID :

Ans.   Official Answer NTA (11)

24.   From the vitamins $A, B_1, B_6, B_{12}, C, D, E\,and\,K$, the number of vitamins that can be stored in our body is

Question ID : 4058591283

Ans.   Official Answer NTA (5)

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25. Number of moles of H^+ ions required by 1 mole of MnO_4^- to oxidise oxalate ion to CO_2 is _____ .

Question ID : 4058591280

Ans. Official Answer NTA (4)

Answer by Matrix is (8)

26. If 5 moles of an ideal gas expands from 10 L to a volume of 100 L a 300 K under isothermal and reversible condition then work, w, is –xJ. The value of x is

(Given $R = 8.314 \, J \, K^{-1} \, mol^{-1}$)

Question ID : 4058591276

Ans. Official Answer NTA (28721)

27. In the reaction of potassium dichromate, potassium chloride and sulfuric acid (conc.), the oxidation state of the chromium in the product is (+) _____ .

Question ID : 4058591284

Ans. Official Answer NTA (6)

28. A diatomic molecule has a dipole moment of 1.2 D. If the bond distance is 1Å, then fractional charge on each atom is 10^{-1} esu.

(Given $1D = 10^{-18} \, esucm$)

Question ID : 4058591275

Ans. Official Answer NTA (0)

29. Number of isomeric products formed by monochlorination of 2-methylbutane in presence of sunlight is

Question ID : 4058591281

Ans. Official Answer NTA (6)

30. The values of conductivity of some materials at 298.15 K in Sm^{-1} are 2.1×10^3, $1.0 \times 10^{-16}, 1.2 \times 10, 3.91, 1.5 \times 10^{-2}, 1 \times 10^{-7}, 1.0 \times 10^3$. The number of conductors among the materials is

Question ID : 4058591278

Ans. Official Answer NTA (4)

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