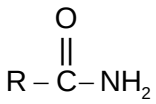
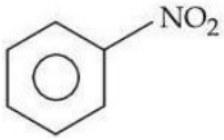
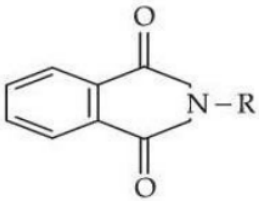
|JEE MAIN 2025 | DATE : 22 JAN 2025 (SHIFT-2) EVENING

CHEMISTRY

SECTION 1

[:Q.51] Match the Compounds **(List – I)** with the appropriate Catalyst/Reagents **(List – II)** for their reduction into corresponding amines.

List – I (Compounds)		**List – II (Catalyst/Regents)**	
(A)		(I)	NaOH (aqueous)
(B)		(II)	H_2/Ni
(C)	$R-C\equiv N$	(III)	$LiAlH_4$, H_2O
(D)		(IV)	Sn, HCl

Choose the **correct** answer from the options given below:

[:A] (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

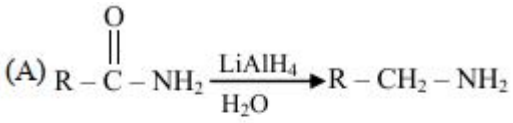
[:B] (A)-(III), (B)-(II), (C)-(IV), (D)-(I)

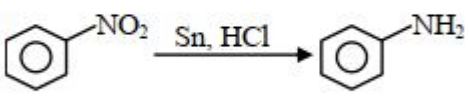
[:C] (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

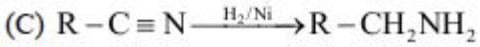
[:D] (A)-(II), (B)-(IV), (C)-(III), (D)-(I)

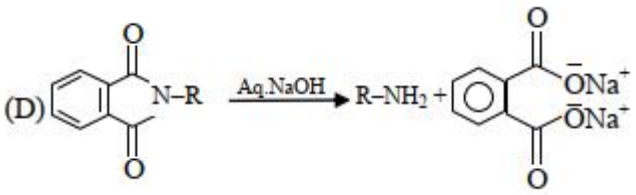
[:ANS] **C**

[:SoLN]

(A) 

(B) 

(C) 

(D) 

[:Q.52] The species which does not undergo disproportionation reaction is:

[A] ClO_2^- [B] ClO^- [C] ClO_3^- [D] ClO_4^-

[:Ans] **D**

[:SOLN] **In** ClO_4^- ; O.N. of Cl is (+7)

Which is maximum O.state of 'Cl' now it so it is not undergo reduction

[:Q.53] Given below are two statements:

Statement (I) : Nitrogen, sulphur halogen and phosphorus present in an organic compound are detected by Lassaigne's Test

Statement (II) : The elements present in the compound are converted from covalent from into ionic form by fusing the compound with Magnesium in Lassaigne's test.

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

[A] Both Statement I and Statement II are false

[B] Both Statement I and Statement II are true

[C] Statement I is true but Statement II is false

[D] Statement I is false but Statement II is true

[:Ans] C

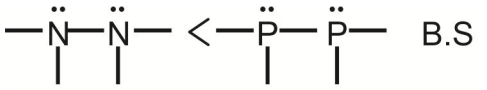
[:SOLN] The element present in the comp. are converted from covalent from into ionic forms. By fusing the comp. with Na.

[:Q.54] The maximum covalency of a non-metallic group 15 element 'E' with weakest E – E bond is:

[A] 3 [B] 4 [C] 5 [D] 6

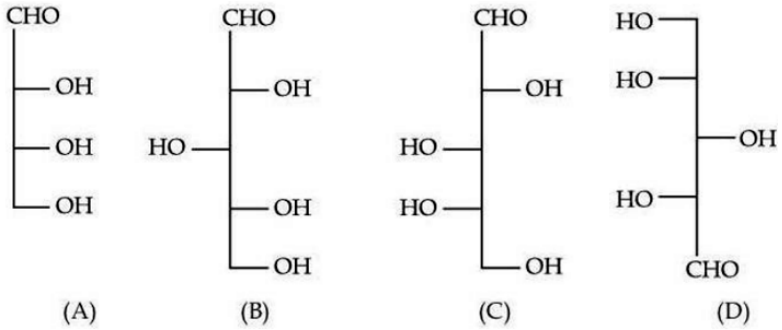
[:Ans] **B**

[:SOLN] N, P -nonmetals



(weakest) — maximum possible covalency of N is 4

[:Q.55] Identify the number of structure /s form the following which can be correlated to D-glyceraldehyde.

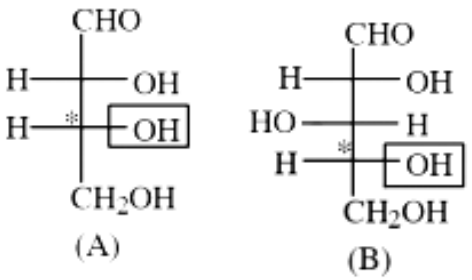


Options

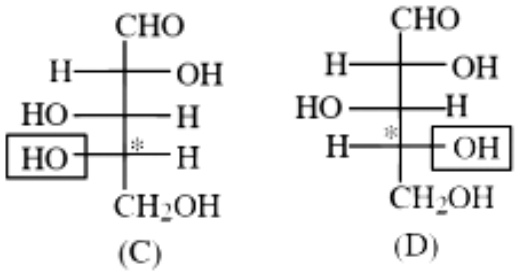
[A] four [B] one [C] two [D] three

[:Ans] **D**

[:SOLN]



D-form D-form



L-form D-form

[:Q.56] Match **List – I** with **List - II**

List – I (Partial Derivatives)	**List – II (Thermodynamic Quantity)**
(A) $\left(\frac{\partial G}{\partial T}\right)_P$	(II) Cp
(B) $\left(\frac{\partial G}{\partial P}\right)_T$	(II) – S
(C) $\left(\frac{\partial G}{\partial P}\right)_T$	(III) Cv
(D) $\left(\frac{\partial U}{\partial T}\right)_V$	(IV) V

Choose the **correct** answer from the options given below:

[:A] (A)-(I), (B)-(II), (C)-(IV), (D)-(III) [:B] (A)-(II), (B)-(I), (C)-(IV), (D)-(III)

[:C] (A)-(II), (B)-(III), (C)-(I), (D)-(IV) [:D] (A)-(II), (B)-(I), (C)-(III), (D)-(IV)

[:Ans] **B**

[:SOLN] From thermodynamics

(i) $dG = VdP - S.dT$ at constant pressure.

$dG = -s.dT$

$\left(\frac{dG}{dT}\right) = -s$

(ii) $dH = nc_p dT$

$\left(\frac{dH}{dT}\right) = C_p$

(iii) $dG = v.dp.s.dT$

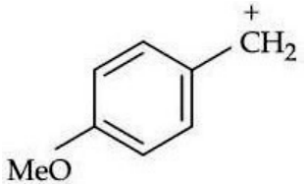
At constant temperature

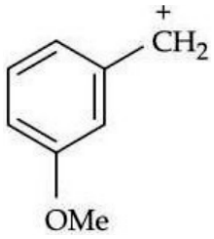
$\frac{dG}{dp} = V$

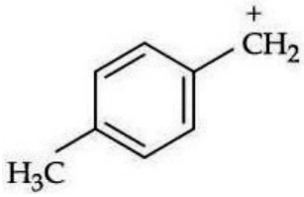
(iv) $dU = nC_v dT$

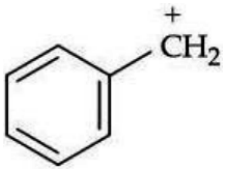
$\frac{dU}{dT} = C_v$

[:Q.57] The most stable carbocation form the following is:

[A] 

[B] 

[C] 

[D] 

[:Ans] **A**

[:SOLN] Due to +M of $-OCH_3$ and also at para passion.

(B) -I of $-OCH_3$

(C) + H of $-CH_3$

[:Q.58] The correct order of the following complexes in terms of their crystal field stabilization energies is

[A] $\left[Co(en)_3\right]^{3+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_4\right]^{2+}$

[B] $\left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(NH_3)_4\right]^{2+} < \left[Co(en)_3\right]^{3+}$

[C] $\left[Co(NH_3)_4\right]^{2+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(en)_3\right]^{3+} < \left[Co(NH_3)_6\right]^{3+}$

[D] $\left[Co(NH_3)_4\right]^{2+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(en)_3\right]^{3+}$

[:Ans] **D**

[:SOLN] $\left[Co(NH_3)_4\right]^{2+} < \left[Co(NH_3)_6\right]^{2+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(en)_3\right]^{3+}$ Basis of CFSE

[:Q.59] Arrange the following compounds in increasing order of their dipole moment:

[A] $H_2S < HBr < NF_3 < CHCl_3$

[B] $CHCl_3 < NF_3 < HBr < H_2S$

[C] $NF_3 < HBr < H_2S < CHCl_3$

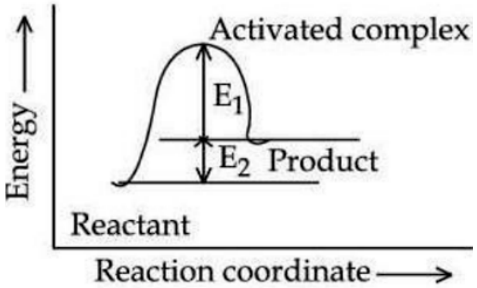
[D] $HBr < H_2S < NF_3 < CHCl_3$

[:Ans] **C**

[:SOLN] $NF_3 < HBr < H_2S < CHCl_3$ Dipole moment

NCERT table 4.5

[:Q.60] Consider the given figure and choose the **correct** option:



Activation energy of backward reaction is E_1 and product is more stable than reactant.

[A] Activation energy of backward reaction is E_1 and product is more stable than reactant.

[B] Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

[C] Activation energy of forward reaction is $E_1 + E_2$ and product is more stable than reactant.

[D] Activation energy of both forward and backward reaction is $E_1 + E_2$ and reactant is more stable than product.

[:Ans] **C**

[:SOLN] Activation energy for forward reaction is $(E_1 + E_2)$

As energy of product is greater than energy of reactant, stability of reactant is higher than stability of product

[:Q.61] Density of 3 M NaCl solution is 1.25 g/mL. The molality of the solution is:

[A] 2m [B] 2.79 m [C] 3 m [D] 1.79 m

[:Ans] **B**

[:SOLN] From the formula

$$\text{Molality} = \frac{M \times 1000}{1000 \times d - M \times (M.W)_{NaCl}}$$

$$= \frac{3000}{1000(1.25) - 175.5} = 2.79$$

[:Q.62] Identify the homoleptic complex(es) that is/are low spin.

(A) $\left[Fe(CN)_5 NO\right]^{2-}$ (B) $\left[CoF_6\right]^3$

(C) $\left[Fe(CN)_6\right]^{4-}$ (D) $\left[Co(NH_3)_6\right]^{3+}$

(E) $\left[Cr(H_2O)_6\right]^{2+}$

Choose the **correct** answer from the options given below:

[A] (C) and (D) only [B] (B) and (E) only [C] (A) and (C) only [D] (C) only

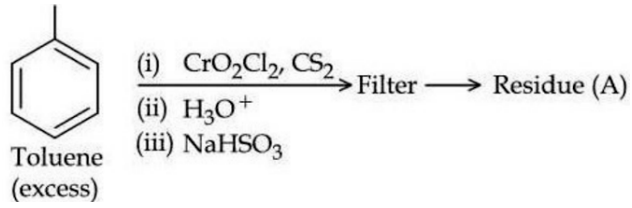
[:Ans] **A**

[:SoLN] $\left[Fe(CN)_6\right]^{4-}$, $\left[Co(NH_3)_6\right]^{3+}$

$Fe^{+2}, 3d^6, d^2sp^3, t_{2g}^6\, eg^0$ $Co^{+3}, 3d^6, d^2sp^3, t_{2g}^6\, eg^0$

Homoleptic and low spin complex

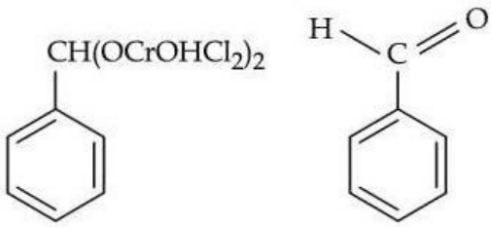
[:Q.63]

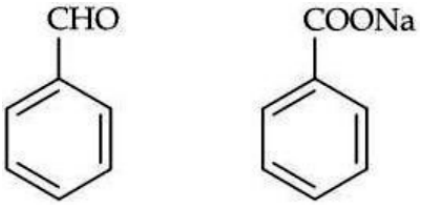


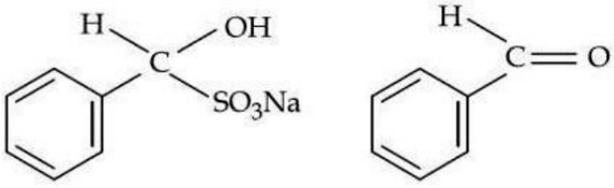
Residue (A) + HCl(dil) → Compound (B)

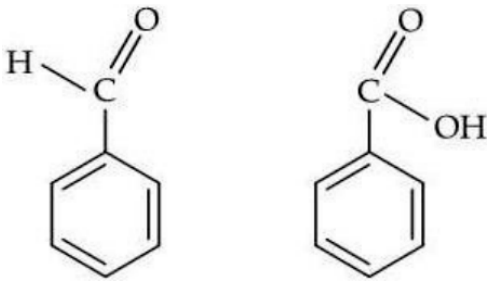
Structure of residue (A) and compoud (B) formed respectively is:

[A] **[B]**

[A] 

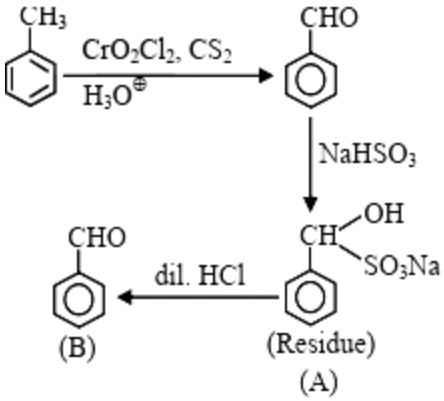
[B] 

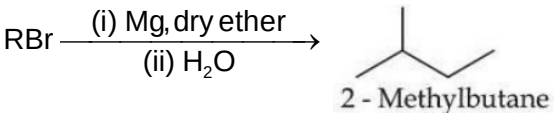
[C] 

[D] 

[:Ans] **C**

[:SOLN]



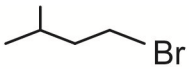
[:Q.64] 

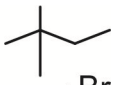
The maximum number of RBr producing 2-methylbutane by above sequence of reactions is _____. (Consider the structural isomers only)

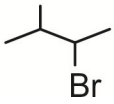
[A] 1 [B] 3 [C] 4 [D] 4

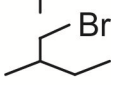
[:Ans] **C**

[:SoLN]

I. 

III. 

II. 

IV. 

[:Q.65] Given below are two statements:

Statement I : Corrosion is an electrochemical phenomenon in which pure metal acts as an anode and impure metal as a cathode.

Statement II : The rate of corrosion is more in alkaline medium than in acidic medium. In the light of the above statemets, choose the **corect** answer from the options given below:

[A] Statement I is false but Statement II is true

[B] Statement I is true but Statement II is false

[C] Both Statement I and Statement II are true

[D] Both Statement I and Statement II are false

[:Ans]

[:Q.66] Given below are two statements:

Statement I : An element in the extreme left of the periodic table forms acidic oxides.

Statement II : Acid is formed during the reaction between water an oxide of a reactive element present in the extreme right of the periodic table.

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

[A] Both Statement I and Statement II are true

[B] Both Statement I and Statement II are false

[C] Statement I is true but Statement II is false

[D] Statement I is false but Statement II is true

[:Ans] **D**

[:SOLN] S.I. Extremely left in P.T. form -basic oxide

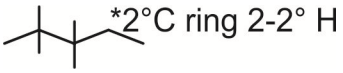
S.II: Oxide of reactive element is right side is acidic in nature.

[:Q.67] The alkane from below having two secondary hydrogens is:

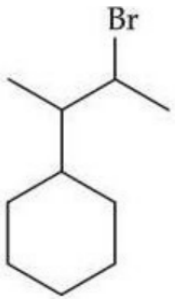
[A] 2,2,4,5-Tetramethylheptane [B] 2,2,3,3-Tetramethylpentane

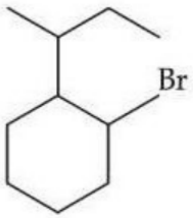
[C] 4-Ethyl-3,4-dimethyloctane [D] 2,2,4,4,-Tetramethylhexane

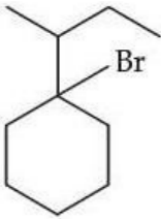
[:Ans] **B**

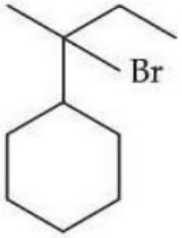
[:SOLN] 

[:Q.68] When sec-butylcyclohexane reacts with bromine in the presence of sunlight, the major product is:

[A] 

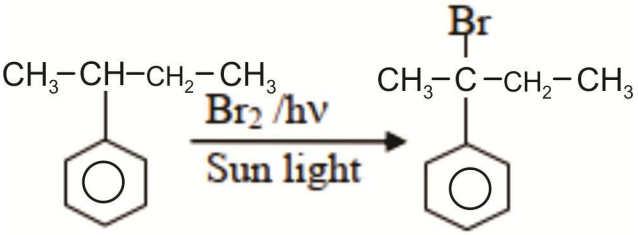
[B] 

[C] 

[D] 

[:Ans] **D**

[:SOLN]



Formation of product through more stable free radical.

[:Q.69] Given below are two statements:

Statement I : A spectral line will be observed for a $2p_x \rightarrow 2p_y$ transition.

Statement II : $2p_x$ and $2p_y$ are degenerate orbitals.

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

[A] Statement I is true but Statement II is false

[B] Both Statement I and Statement II are false

[C] Both Statement I and Statement II are true

[D] Statement I is false but Statement II is true

[Ans]

[:Q.70] The molar solubility(s) of zirconium phosphate with molecular formula $\left(Zr^{4+}\right)_3\left(PO_4^{3-}\right)_4$ is given by relation:

[A] $\left(\frac{K_{sp}}{8435}\right)^{\frac{1}{7}}$ [B] $\left(\frac{K_{sp}}{962}\right)^{\frac{1}{3}}$ [C] $\left(\frac{K_{sp}}{5348}\right)^{\frac{1}{6}}$ [D] $\left(\frac{K_{sp}}{6912}\right)^{\frac{1}{7}}$

[:Ans] **D**

[:SoLN] Let solubility is "S"

$$Zr_3\left(PO_4\right)_{4(s)} \rightleftharpoons 3Zr^{+4} + 4PO_4^{-3}$$

$$K_{sp} = \left[Zr^{4+}\right]^3 \left[PO_4^{-3}\right]^4 = (3s)^3 (4s)^4$$

$$K_{sp} = 3^3.4^4.5^7 = 6912 \times 5^7$$

$$s = \left\{\frac{k_{sp}}{6912}\right\}^{1/7}$$

SECTION2

[:Q.71] 20 mL of 2 M NaOH solution is added to 400 mL of 0.5 M NaOH solution. The final concentration of the solution is _____ $\times 10^{-2}$ M. (Nearest integer)

[Ans] **57**

[:SOLN] **As we know that**

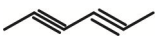
$$M_{mix} = \frac{M_1V_1 + M_2V_2}{V_1 + V_2} = \frac{2 \times 20 + 0.5 \times 400}{20 + 400} = 0.571M = 57.1 \times 10^{-2}M$$

[:Q.72. The compound with molecular formula C_6H_6, which gives only one monobromo derivative and takes up four moles of hydrogen per mole for complete hydrogenation has _____ π electrons.

[:Ans] **8**

[:SOLN] **M.G.** $\rightarrow C_6H_6$

D.U. $\rightarrow 4$



[:Q.73] Consider the following cases of standard enthalpy of reaction $\left[\Delta H_r^\circ \text{ in kJ mol}^{-1}\right]$

$$C_2H_6(g) + \frac{7}{2}O_2(g) \rightarrow 2CO_2(g) + 3H_2O(1)\ \Delta H_1^\circ = -1550$$

$$C(\text{graphite}) + O_2(g) \rightarrow CO_2(g)\ \Delta H_2^\circ = -393.5$$

$$H_2 9(g) + \frac{1}{2}O_2 \rightarrow H_2O(1)\ \Delta H_3^\circ = -286$$

The magnitude of $\Delta H_{f\ C_2H_6(g)}^\circ$ is _____ kJ mol^{-1} (Nearest integer).

[:Ans] **95**

[:SOLN] The reaction for formation of C_2H_6 is

$$2C_{(\text{graphite})} + 3H_{2(g)} \longrightarrow C_2H_6;\ (\Delta H_f)_4 = ?$$

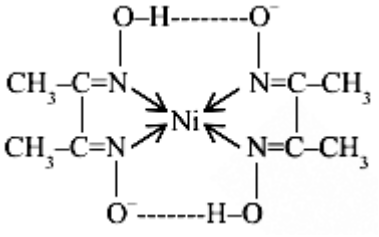
$$(\Delta H_f)_4 = 2 \times \Delta H_2 + 3\Delta H_3 - \Delta H_1$$

= 95 KJ /mole

[:Q.74] The complex of Ni^{2+} ion and dimethyl glyoxime contains _____ number of Hydrogen (H) atoms

[:Ans] **14/BONUS due to incomplete information**

[:SOLN]



[:Q.75] Niobium (Nb) and ruthenium (Ru) have “x” and “y” number of electrons in their respective 4d orbitals. The value of x + y is _____.

[:Ans] **11**

[:SOLN] **Nb, Ru**

$Nb - [Kr]4d^4 5s^1$

41

$Ru_{44} - [Kr]4d^7 5s^1$

x = 4, y = 7

x + y =11