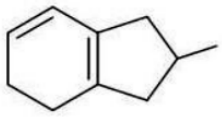
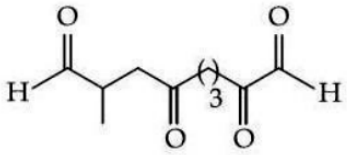
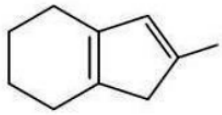
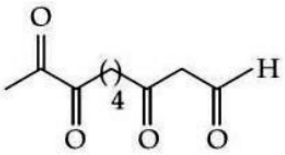
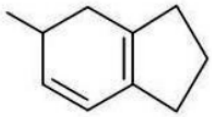
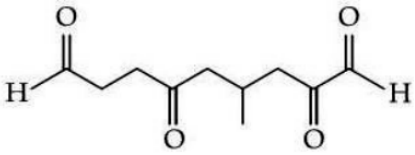
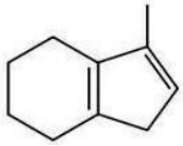
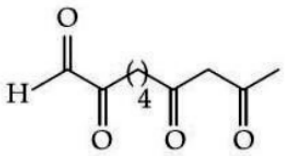
|JEE MAIN 2025 | DATE : 23 JAN 2025 (SHIFT-2) EVENING

CHEMISTRY

SECTION 1

[:Q.51] Match List – I with List - II.

List – I (Isomers of $C_{10}H_{14}$)		**List – II** (Ozonolysis product)	
(A)		(I)	
(B)		(II)	
(C)		(III)	
(D)		(IV)	

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

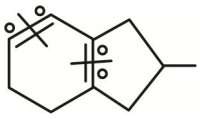
[:A] (A)-(III), (B)-(IV), (C)-(I), (D)-(II)

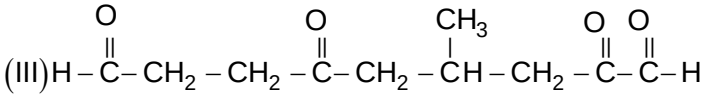
[:B] (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

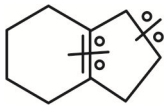
[:C] (A)-(I), (B)-(IV), (C)-(III), (D)-(II)

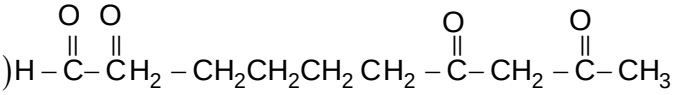
[:D] (A)-(III), (B)-(II), (C)-(I), (D)-(IV)

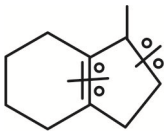
[:ANS] **A**

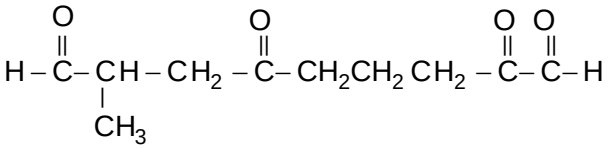
[:SoLN] **(A)** 

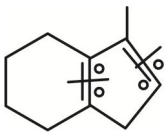
(III) 

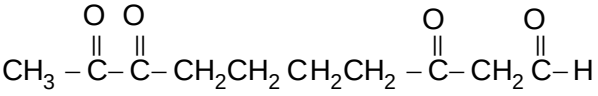
(B) 

(IV) 

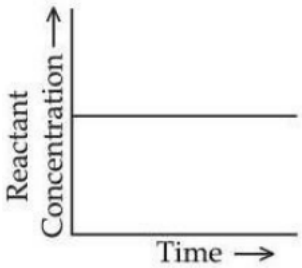
(C) 

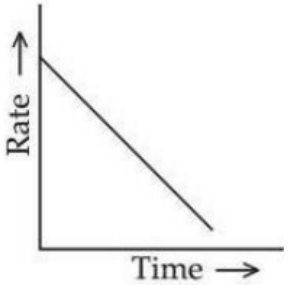
(I) 

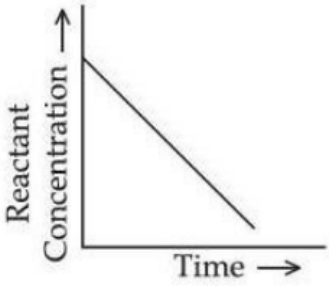
(D) 

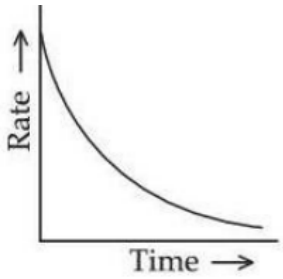
(II) 

[:Q.52] Which of the following graphs most appropriately represents a zero order reaction?

[A] 

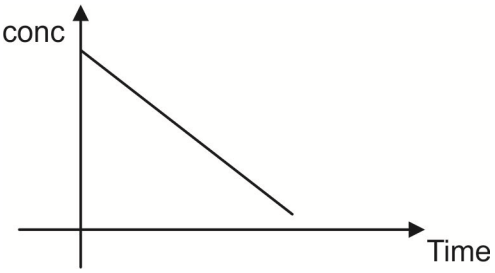
[B] 

[C] 

[D] 

[:Ans] **C**

[:SOLN] **zero order**



[:Q.53] Match **List – I** with **List – II**.

	List – I		**List – II**
(A)	Bronze	(I)	Cu, Ni
(B)	Brass	(II)	Fe, Cr, Ni, C
(C)	UK silver coin	(III)	Cu, Zn
(D)	Stainless steel	(IV)	Cu, Sn

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

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

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

[:Ans] **B**

[:SoLN] (A) Bronze –(iii) Cu, SN

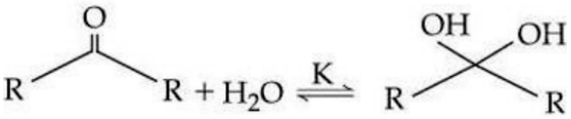
(B) Brass-(IV) Cu, Zn

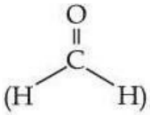
(C) UK silver coin –(i) Cu, Ni

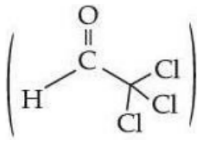
(D) Stainless steel – (ii) Fe, Cr, Ni, C

[:Q.54] Given below are two statements:

Consider the following reaction



Statement I : In the case of formaldehyde  , K is about 2280, due to small subtituents, hydration is faster.

Statement II : In the case of trichloro acetaldehyde  , K is about 2000 due to – I effect – Cl.

In the light of the above statements, choose the **correct** 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] **B**

[SoLN] **Statement (I) is true but statemnt (II) is false**

[:Q.55] Given below are the atomic numbers of some group 14 elements. The atomic number of the element with lowest melting point is:

[A] 82 [B] 6 [C] 50 [D] 14

[:Ans] **C**

[SOLN] **Group -14.**

M.P.

$C > Si > Ge > Pb > Sn$

$\downarrow \quad \downarrow \quad \downarrow \quad \downarrow \quad \downarrow$

6 14 32 82 50

[Q.56] 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 $\frac{1}{x_1}$ vs $\frac{1}{y_1}$ are given respectively as:

[A] $\frac{P_2^0}{P_1^0}, \frac{P_2^0 - P_1^0}{P_2^0}$ [B] $\frac{P_1^0}{P_2^0}, \frac{P_1^0 - P_2^0}{P_2^0}$ [C] $\frac{P_2^0}{P_1^0}, \frac{P_1^0 - P_2^0}{P_2^0}$ [D] $\frac{P_1^0}{P_2^0}, \frac{P_2^0 - P_1^0}{P_2^0}$

[:Ans] **B**

[:SoLN] $P_1^0 X_1 = \left(P_1^0 X_1 + P_2^0 X_2\right) y_1$

$$\frac{1}{y_1} = 1 + \frac{P_2^0}{P_1^0}\frac{X_2}{X_1}$$

$$\frac{1}{y_1} = 1 + \frac{P_2^0}{P_1^0}\frac{(1 - X_1)}{X_1}$$

$$\frac{1}{y_1} = \left(1 - \frac{P_2^0}{P_1^0}\right) + \frac{P_2^0}{P_1^0 X_1}$$

$$\frac{P_2^0}{P_1^0 x_1} = \frac{1}{y_1} - \left(\frac{P_1^0 - P_2^0}{P_1^0}\right)$$

$$\frac{1}{X_1} = \frac{1}{y} \times \frac{P_1^0}{P_2^0} - \left(\frac{P_1^0 - P_2^0}{P_1^0}\right)\frac{P_1^0}{P_2^0}$$

$$\text{Slope} = \frac{P_1^0}{P_2^0}$$

Intercept $= \dfrac{P_1^0 - P_2^0}{P_2^0}$

[Q.57] Given below are two statements about X-ray spectra of elements:

Statement I : A plot of $\sqrt{\nu}$ (ν = frequency of X-rays emitted) vs atomic mass is a straight line.

Statement II : A plot of ν (ν = 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:

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

[B] Both Statement I and Statement II are true

[C] Both Statement I and Statement II are false

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

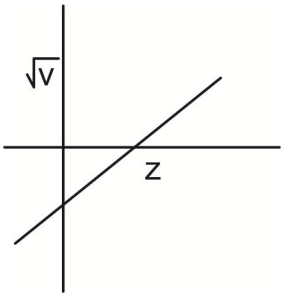
[:Ans] **C**

[:SOLN] $\sqrt{v} = a(z-b)$

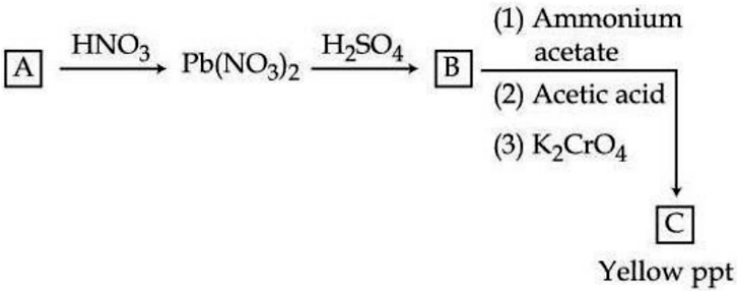
$\sqrt{v} = az - ab$

$y = mx + c$

Plot of $\sqrt{v}$ vs z is straight line



[Q.58] Identify A, B and C in the given below reaction sequence



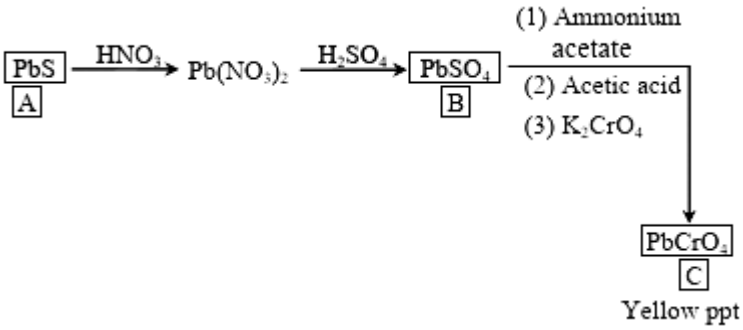
[A] $PbCl_2, PbSO_4, PbCrO_4$

[B] $PbS, PbSO_4, Pb(CH_3COO)_2$

[C] $PbS, PbSO_4, PbCrO_4$ [D] $PbCl_2, Pb(SO_4)_2, PbCrO_4$

[:Ans] **C**

[:SOLN]



[Q.59] When a non-volatile solute is added to the solvent, the vapour pressure of the solvent decreases by 10 mm of Hg. The more fraction of the solution is 0.2. What would be the mole fraction of the solvent if decrease in vapour pressure is 20 mm of Hg?

[A] 0.8 [B] 0.6 [C] 0.4 [D] 0.2

[:Ans] **B**

[:SOLN] $\frac{\Delta P}{P^0}$ = Relative lowering of vapour press.

$$\frac{\Delta P}{P^0} = X_B = 0.2$$

$$\frac{10}{P^0} = 0.2$$

$$\frac{20}{P^0} = x_{solute}$$

$$\frac{x}{0.2} = \frac{20}{10}$$

$$x = 0.4$$

$$x_{solvent} = 0.6$$

[Q.60] Standard electrode potentials for a few half cells are mentioned below:

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

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

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

[A] $Ag|Ag^{+}(1M)||Mg^{2+}(1M)|Mg$ [B] $Zn|Zn^{2+}(1M)||Ag^{+}(1M)|Ag$

[C] $Cu|Cu^{2+}(1M)||Ag^{+}(1M)|Ag$ [D] $Zn|Zn^{2+}(1M)||Mg^{2+}(1M)|Mg$

[:Ans] **B**

[:SoLN] $Zn|Zn^{+2}||Ag^{+}|Ag$ will give maximum +ve

Ecell

$\therefore$ Minimum ΔG

[Q.61] The α – Helix and β – Pleated sheet structures of protein are associated with its:

[A] tertiary structure [B] secondary structure

[C] quaternary structure [D] primary structure

[:Ans] **B**

[:SOLN] **Secondary , structure**

[Q.62] pH of water is 7 at 25°C. if water is heated to 80°C., it's pH will:

[A] H^{+} concentration increases, OH^{-} concentration decreases

[B] Decrease

[C] Increase

[D] Remains the same

[:Ans] **C**

[:SOLN] **PH at 80°C will decreases.**

[Q.63] The effect of temperature on spontaneity of reaction 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:

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

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

[:Ans] **B& C**

	ΔH	ΔS	T	Spontaneity
[:SOLN]	(A) +	-	any T	Non spon

(B) +	+	low T	spon
(c) -	-	low	non -spon
(D) -	+	any T	spontan

[Q.64] 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 point 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:

[A] Both Statement I and Statement II are false

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

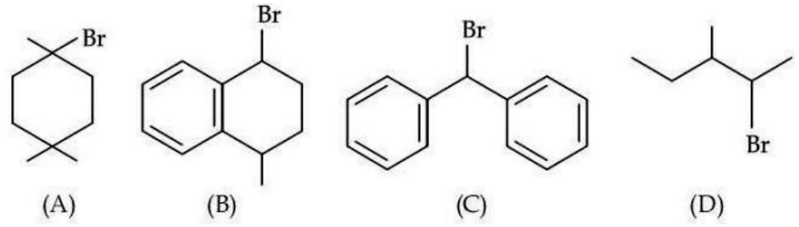
[C] Statement I is false but Statement II is true

[D] Both Statement I and Statement II are true

[:Ans] **D**

[:SOLN] **Both statement I and Statement II are true**

[Q.65] The ascending order of relative of solvolysis of following compounds is:



[A] (C) < (D) < (B) < (A)

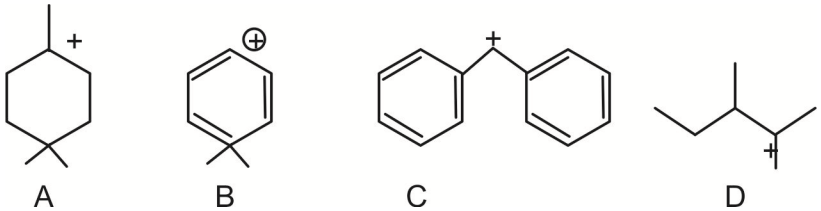
[B] (D) < (B) < (A) < (C)

[C] (C) < (B) < (A) < (D)

[D] (D) < (A) < (B) < (C)

[:Ans] **D**

[SOLN] It depends on stability of carbocation



C > B > A > D

[:Q.66] Consider the reaction

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

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 small.

[A] $x = \sqrt[3]{\frac{Kp}{2p}}$ [B] $x = \sqrt[3]{\frac{Kp}{p}}$ [C] $x = \sqrt[3]{\frac{2Kp^2}{p}}$ [D] $x = \sqrt[3]{\frac{2Kp}{p}}$

[:Ans] **C**

[:SOLN] $X_2Y(g) \rightleftharpoons X_2(g) + \frac{1}{2}Y_2(g)$

1-x x x/2

Total mol = $1 - x + x + \frac{x}{2} = \left(1 + \frac{x}{2}\right)$

$$\therefore K_p = \frac{\left(\frac{x}{1+x/2}\right)P \times \left(\frac{x/2}{1+x/2}\right)^{1/2} \times p^{1/2}}{\left(\frac{1-x}{1+\frac{x}{2}}\right) \times p}$$

$$\therefore K_p = \frac{x^{3/2}P^{1/2}}{2^{1/2}}$$

$$x^{3/2} = \left(\frac{K_p \times 2^{1/2}}{P^{1/2}}\right)$$

$$x = \sqrt[3]{\frac{2K_p^2}{P}}$$

[:Q.67] 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:

[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] **C**

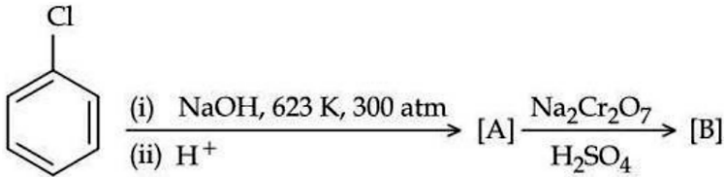
[:SOLN] For n $\rightarrow$ no. of orbitals $= n^2$

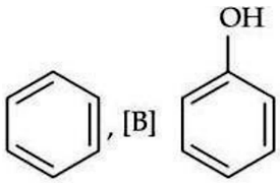
Spatial arrangement = -l to +l

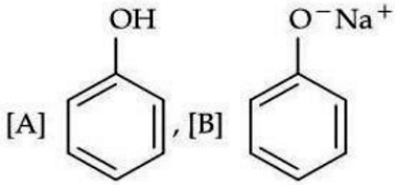
Including 0

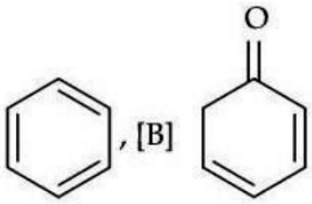
Both statement is true

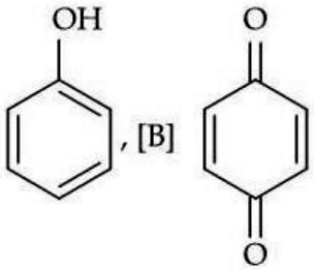
[:Q.68] Identify the products [A] and [B], respectively in the following reaction:



[A] 

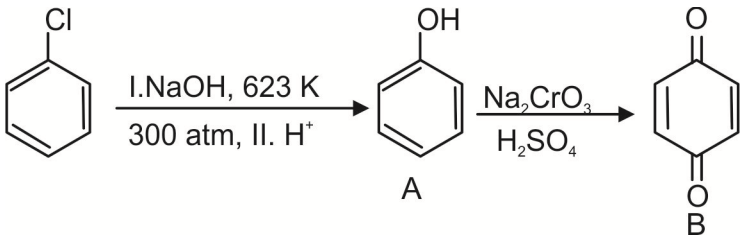
[B] 

[C] 

[D] 

[:Ans] **D**

[:SOLN]



[:Q.69] 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:

[A] K_2CrO_4 and $K_2Cr_2O_7$

[B] K_2Cro_4 and CrO

[C] $K_2Cr(OH)_6$ and Cr_2O_3 [D] K_2CrO_4 and Cr_2O_3

[:Ans] **A**

[:SoLN]

$$K_2Cr_2O_7 \xrightarrow[-H_2O]{KOH} \underset{[A]}{K_2CrO_4} \xrightarrow[-H_2O]{H_2SO_4} \underset{[B]}{K_2Cr_2O_7} + K_2SO_4$$

[:Q.70] Identify the coordination complexes in which the central metal ion has d^4 configuration.

(A) $[FeO_4]^{2-}$ (B) $[Mn(CN)_6]^{3-}$ (C) $[Fe(CN)_6]^{3-}$

(D) $Cr_2\left(O-\overset{\overset{O}{\|}}{C}-Me\right)_4(H_2O)_2$ (E) $[NiF_6]^{2-}$

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

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

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

[:Ans] **B**

[:SOLN] **A.** $[FeO_4]^{2-} - Fe^{6+} - 3d^2$

B. $[Mn(CN)_6]^{3-} - Mn^{3+} - 3d^4$

C. $[Fe(CN)_6]^{3-} - Fe^{3+} - 3d^5$

D. $\left[Cr_2\left(O-\overset{\overset{O}{\|}}{C}-Me\right)_4(H_2O)_2\right] - Cr^{2+} - 3d^4$

E. $[NiF_6]^{2-} - Ni^{4+} - 3d^6$

Numerical

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

[:Ans] **100 g/ml**

[SOLN] **0.01 mol**

Let molar mass = x g/mol

$$\therefore \frac{0.01\times x\,g}{0.9\,g\,H_2O}$$

$$\therefore \frac{0.01\times 100}{0.01\times x}\times 100 = 10$$

X = 100 g/mol

$$n_{H_2O} = \frac{0.9}{18}\text{mol}$$

$$n_H = \frac{0.9}{9}\text{mol}$$

$$n_H = 0.1\,\text{mol}$$

$$W_H = 0.1\text{g}$$

[:Q.72] When 81.0 g of aluminum is allowed to react with 128.0 g of oxygen gas, the mass of alumnium 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] **153g**

[:SOLN] $4Al + 3O_2 \rightarrow 2Al_2O_3$

$$n_{Al} = \frac{81}{27} = 3\,\text{mol}$$

$$n_{O_2} = \frac{128}{32} = 4\,\text{mol}$$

Limiting reagent = Al

$$\therefore n_{Al_2O_3} = 1.5\,\text{mol}$$

$$w_{Al_2O_3} = 108\times 1.5\ \text{mol}$$

[:Q.73] The bond dissociation enthalpy of X_2 ΔH°_{bond} calculated from the given data is _____

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

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

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

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

$$M(s) + \frac{1}{2}X_2(g) \rightarrow M^+X^-(s)\ \ \Delta H^\circ_{f} = -400\ kJ\ mol^{-1}$$

[Given: M^+X^- is a pure ionic compound and X forms a diatomic moleule X_2 in gaseous state]

[:Ans] **200**

[:SoLN] $M(S) + \frac{1}{2}X_{2(g)} \rightarrow MX(s)$

$\downarrow \Delta H_{sublimiation}$ $\downarrow B.EX_{1/2}$

M(g) X(g)

$\downarrow I.E_I$ $\downarrow \Delta H, E_{GE}$

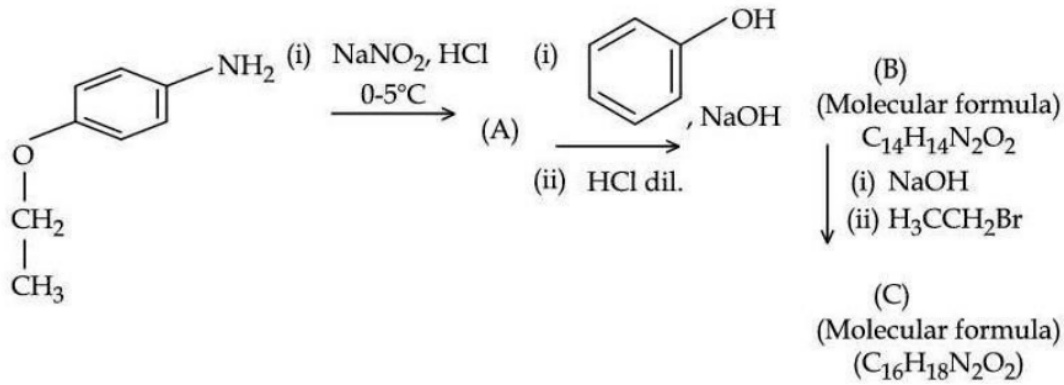
$M^+(g) + X^-(g)$

$$-400 = 100 + 500 + \frac{1}{2}B.E + (-300)(-800)$$

$$400 = 300 + \frac{1}{2}B.E$$

B.E. = 200 kJ /mol

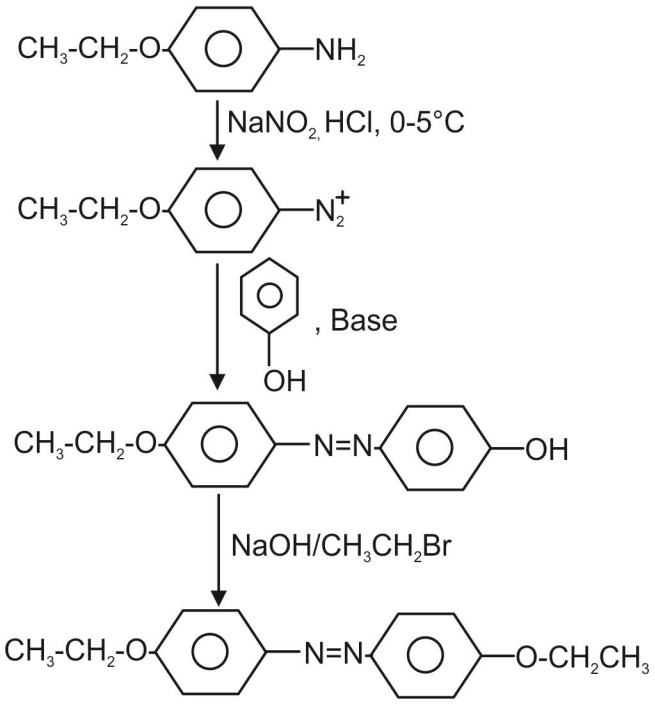
[:Q.74] Consider the following sequence of reactions.



Total number of sp^3 hybridised carbon atoms in the major product C formed is _____.

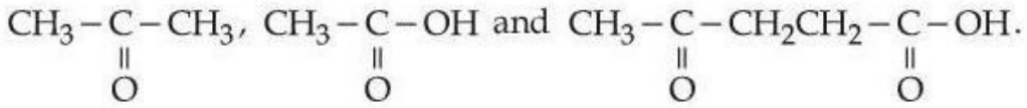
[:Ans] **4**

[:SoLN]



Total sp3 hybridised carbon = 4

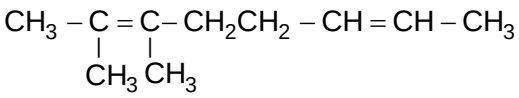
[:Q.75] A compound 'X' absorbs 2 moles of hydrogen and 'X' upon oxidation with $KmnO_4$ | H^+ gives



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

[:Ans] **27**

[:SoLN] **Comopund is**



Mol . formula = $C_{10}H_{18}$

No. of bonds = total no. of atoms -1 =28-1 = 27