CHEMISTRY
JEE-MAIN (July-Attempt)
28 July (Shift-2) Paper Solution

SECTION - A

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

Assertion A : Zero orbital overlap is an out of phase overlap.

Reason R : It results due to different orientation/direction of approach of orbitals.

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

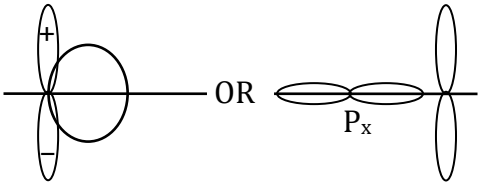
(A) Both A and R are true and R is the correct explanation of A

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

(C) A is true but R is false

(D) A is false but R is true

Sol. **A**



Zero overlapping

Zero overlapping due to improper orientation of orbitals

2. The correct decreasing order for metallic character is

(A) Na>Mg>Be>Si>P

(B) P>Si>Be>Mg>Na

(C) Si>P>Be>Na>Mg

(D) Be>Na>Mg>Si>P

Sol. **A**

Na > Mg > Be > Si > P

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

Assertion A : The reduction of a metal oxide is easier if the metal formed is in liquid state than solid state.

Reason R : The value of ΔG^{-} becomes more on negative side as entropy is higher in liquid state than solid state.

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

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

(B) Both A and R are correct but R is NOT the correct explanation of A

(C) A is correct but R is not correct

(D) A is not correct but R is correct

Sol. **A**

$\Delta G = \Delta - T\Delta S$

So on melting entropy increases and ΔG become more negative so metal ion get easily reduced.

4. The products obtained during treatment of hard water using Clark's method are :

(A) $CaCO_3$ and $MgCO_3$ (B) $Ca(OH)_2$ and $Mg(OH)_2$

(C) $CaCO_3$ and $Mg(OH)_2$ (D) $Ca(OH)_2$ and $MgCO_3$

Sol. **C**

$Ca(HCO_3)_2 + Ca(OH)_2 \rightarrow 2CaCO_3 + 2H_2O$

$Mg(HCO_3)_2 + 2Ca(OH)_2 \rightarrow 2CaCO_3 + Mg(OH)_2 + 2H_2O$

5. **Statement I :** An alloy of lithium and magnesium is used to make aircraft plates.

Statement II : The magnesium ions are important for cell-membrane integrity.

In the light 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

Sol. **B**

→ Al and Mg is used to make aircraft plates

→ Ca ions are important for cell membrane.

6. White phosphorus reacts with thionyl chloride to give

(A) PCl_5, SO_2 and S_2Cl_2 (B) PCl_3, SO_2 and S_2Cl_2

(C) PCl_3, SO_2 and Cl_2 (D) PCl_5, SO_2 and Cl_2

Sol. **B**

$P_4 + 8SO_2Cl_2 \rightarrow 4PCl_3 + 4SO_2 + 2S_2Cl_2$

7. Concentrated HNO_3 reacts with Iodine to give

(A) HI, NO_2 and H_2O (B) HIO_2, N_2O and H_2O

(C) HIO_3, NO_2 and H_2O (D) HIO_4, N_2O and H_2O

Sol. **C**

$I_2 + 10HNO_3 \rightarrow 2HIO_3 + 10NO_2 + 4H_2O$

So on melting entropy increases and ΔG become more negative so metal ion get easily reduced.

8. Which of the following pair is not isoelectronic species?

(At. No. Sm, 62; Er, 68; Yb, 70; Lu, 71; Eu, 63; Tb, 65; Tm, 69)

(A) Sm^{2+} and Er^{3+} (B) Yb^{2+} and Lu^{3+} (C) Eu^{2+} and Tb^{4+} (D) Tb^{2+} and Tm^{4+}

Sol. **A, D**

$Sm^{+2} \rightarrow 60e^-$ $Er^{+3} \Rightarrow 65e^-$	$yb^{+2} \rightarrow 68e^-$ $Lu^{+3} \rightarrow 68e^-$
$Eu^{+2} = 61e^-$ $Tb^{+4} = 61e^-$	$Tb^{+2} = 63e^-$ $Tm^{+4} = 65e^-$

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

Assertion A : Permanganate titrations are not performed in presence of hydrochloric acid.

Reason R : Chlorine is formed as a consequenceof oxidation of hydrochloric acid.

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

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

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

(C) A is true but R is false

(D) A is false but R is true

Sol. **A**

$2KMnO_4 + 16HCl \rightarrow 2MnCl_2 + 2KCl + 8H_2O + Cl_2(gas)$

$KMnO_4$ oxidise HCl to Cl_2 that's why for acidic medium HCl is not used in permagamate titration.

10. Match List I with List II

List I (Complex)	List II (Hydridization)
A. $Ni(CO)_4$	I. sp^3
B. $[Ni(CN)_4]^{2-}$	II. Sp^3d^2
C. $[Co(CN)_6]^{3-}$	III. d^2sp^3
D. $[CoF_6]^{3-}$	IV. dsp^2

Choose the correct answer from the options given below:

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

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

Sol. **B**

(A) $Ni(CO)_4$

$Co \rightarrow SFL \rightarrow$ Pairing

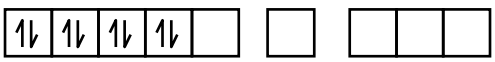
$_{28}Ni \rightarrow [Ar]4s^23d^8$

Sp^3 Hybridisation

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

$CN \rightarrow SFL \rightarrow$ Pairing

$_{28}Ni^{+2} \rightarrow [Ar]\ 4s^03d^8$

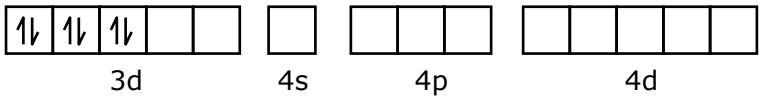


dsp^3 Hybridisation

(C) $[Co(CN)_6]^{-3}$

CN →SFL → Pairing

$_{27}Co^{+3} \rightarrow [Ar]4s^0 3d^6$

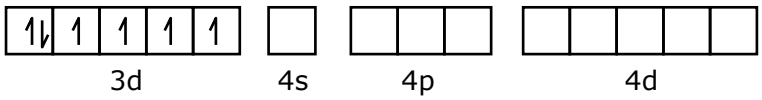


d^2sp^3 hybridisation

(D) $[CoF_6]^{-3}$

F → WFL → Pairing not possible

$_{27}Co^{+3} \rightarrow [Ar]4s^0 3d^6$



sp^3d^2 hybridisation

A → I, B → IV, C → III, D → II

11. Dinitrogen and dioxygen, the main constituents of air do not react with each other in atmosphere to form oxides of nitrogen because

(A) N_2 is unreactive in the condition of atmosphere.

(B) Oxides of nitrogen are unstable.

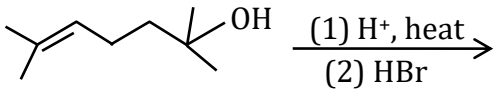
(C) Reaction between them can occur in the presence of a catalyst.

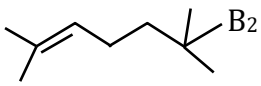
(D) The reaction is endothermic and require very high temperature.

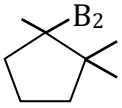
Sol. **D**

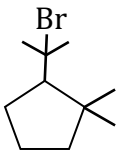
The reaction is endrothermic and require very high temperature.

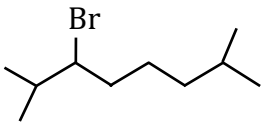
12. The major product in the given reaction is



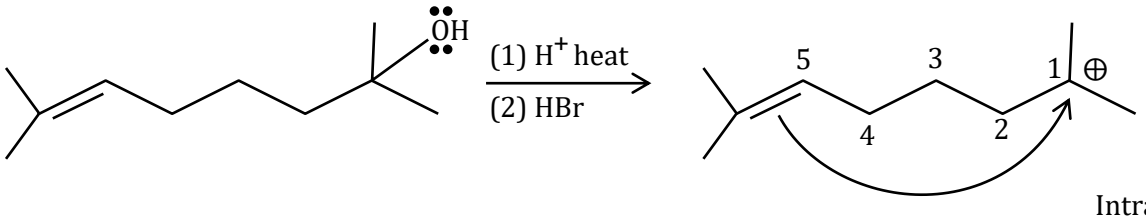
(A) 

(B) 

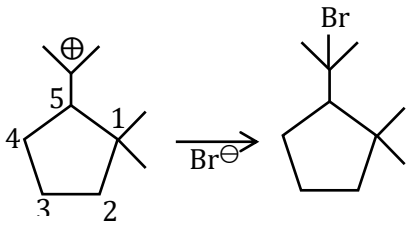
(C) 

(D) 

Sol. **C**



Intra moleculas cyclization



13. Arrange the following in increasing order of reactivity towards nitration

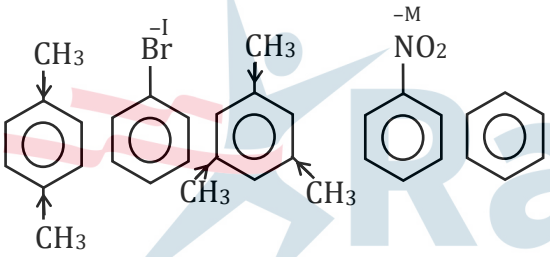
A. p-xylene B. bromobenzene C. mesitylene D. nitrobenzene

E. benzene

Choose the correct answer from the options given below

(A) C<D<E<A<B (B) D<B<E<A<C (C) D<C<E<A<B (D) C<D<E<B<A

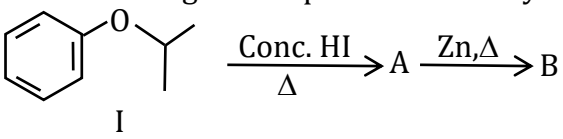
Sol. **B**



(A) (B) (C) (D) (E)

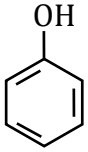
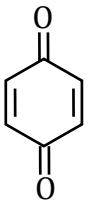
NO_2 – deactivating Br – deactivating CH_3 – activating

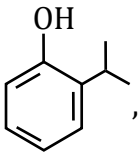
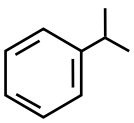
14. Compound I is heated with Conc. HI to give a hydroxy compound A which is further heated with Zn dust give compound B. Identify A and B.

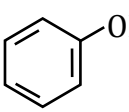


I

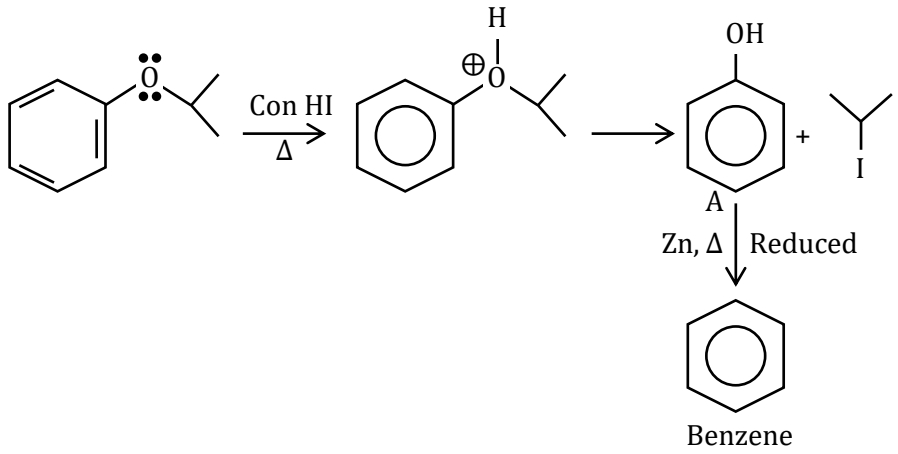
(A) A =  , B = 

(B) A =  , B = 

(C) A =  , B = 

(D) A =  , B = 

Sol. **D**



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

Assertion A : Aniline on nitration yields ortho, meta & para nitro derivatives of aniline.

Reason R : Nitrating mixture is a strong acidic mixture.

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

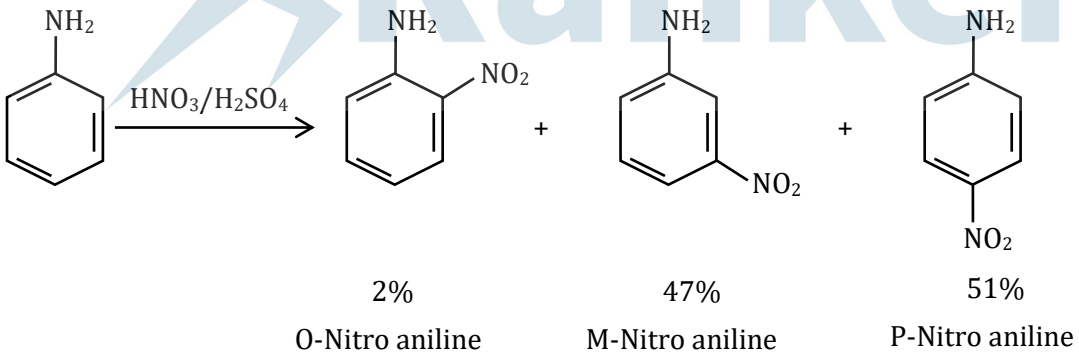
(A) Both A and R are true and R is the correct explanation of A

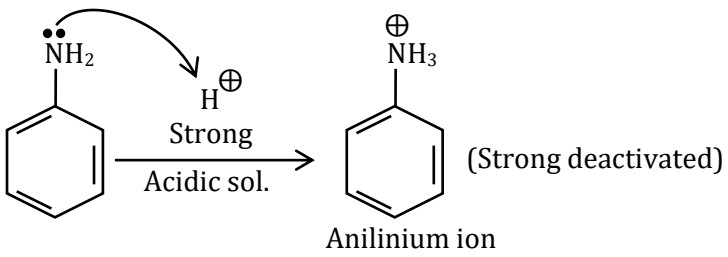
(B) Both A and R are true but R is NOT the correct explanation of A

(C) A is true but R is false

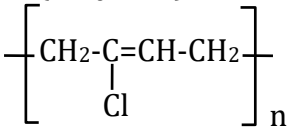
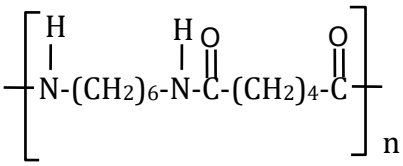
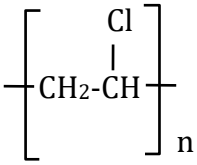
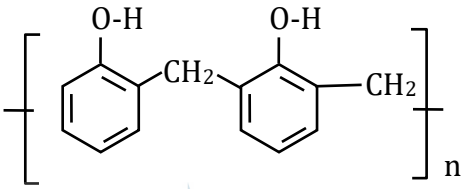
(D) A is false but R is true

Sol. **A**





16. Match List I with List II

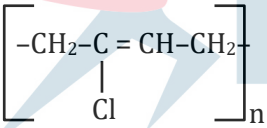
List I (Polymer)	**List II (Nature)**
A. 	I. Thermosetting polymer
B. 	II. Fibers
C. 	III. Elastomer
D. 	IV. Thermoplastic polymer

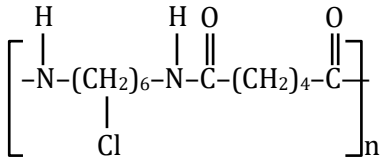
Choose the correct answer from the options given below:

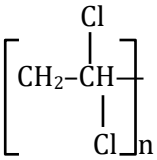
(A) A-II, B-III, C-IV, D-1 (B) A-III, B-II, C-IV, D-I

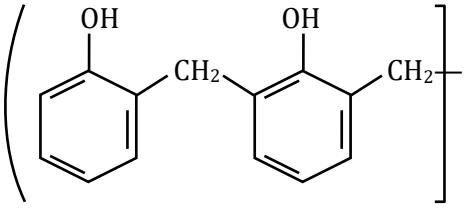
(C) A-III, B-I, C-IV, D-II (D) A-I, B-III, C-IV, D-II

Sol. **B**

(A)  ⟶ Elastoners

(B)  ⟶ Fibers

(C)  ⟶ Thermoplactice polymer

(D)  ⟶ Thermoselting polymer

17. Two statement in respect of drug-enzyme interaction are given below

Statement I : Action of an enzyme can be blocked only when inhibitor blocks the active site of the enzyme.

Statement II : An inhibitor can form a strong covalent bond with the enzyme.

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

Sol. **D**

Drug can bond (a) active sites (b) (allosteric site) of enzyme by formation of covalant bond.

Based on durg can be called (a) competitive inhibitors and (b) non-competitive inhibitors.

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

Assertion A : Thin layer chromatography is an adsorption chromatography.

Reason R : A thin layer of silica gel is spread over a glass plate suitable size in thin layer chromatography which acts as an adsorbent.

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

(A) Both A and R are true and R is correct explanation ofA

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

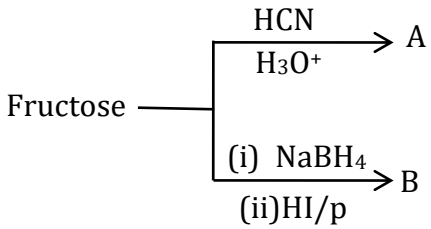
(C) A is true but R is false

(D) A is false but R is true

Sol. **A**

Thin layer chromatography is a adsorption chromotography and silica get coated on glass plate in thin layer chromatography is used as adsorbent.

19. The formulas of A and B for the following reaction sequence



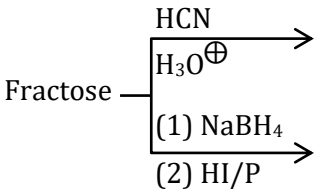
(A) A = $C_7H_{14}O_8$, B = C_6H_{14}

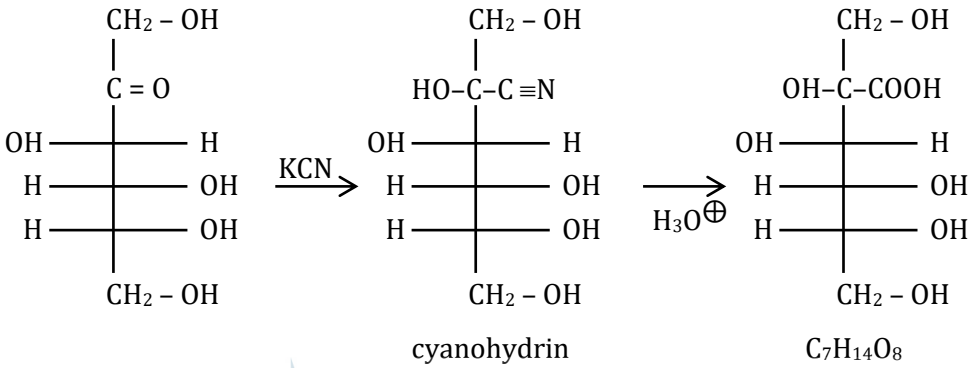
(B) A = $C_7H_{13}O_7$, B = $C_7H_{14}O$

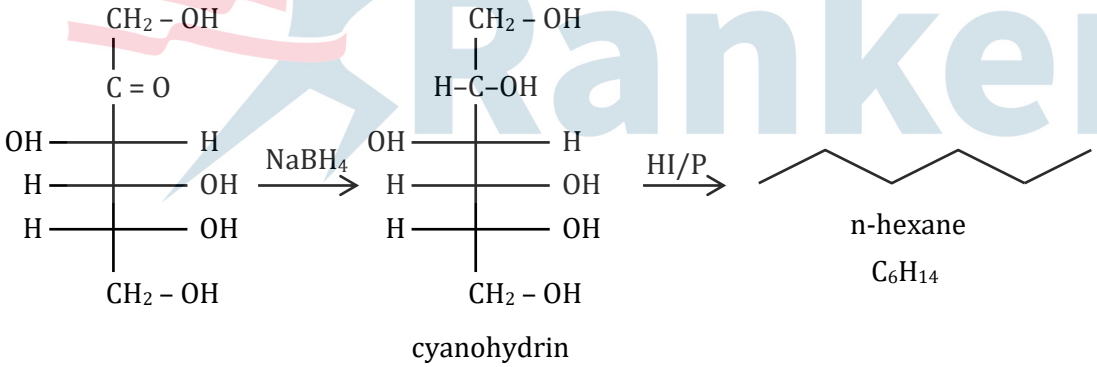
(C) A = $C_7H_{12}O_8$, B = C_6H_{14}

(D) A = $C_7H_{14}O_8$, B = $C_6H_{14}P_6$

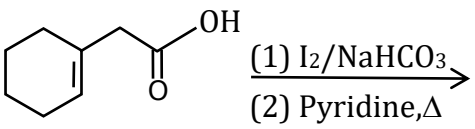
Sol. **A**



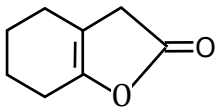


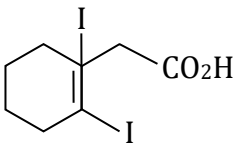


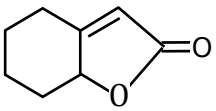
20.

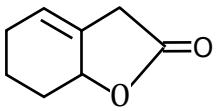


Find out major product for the above reaction.

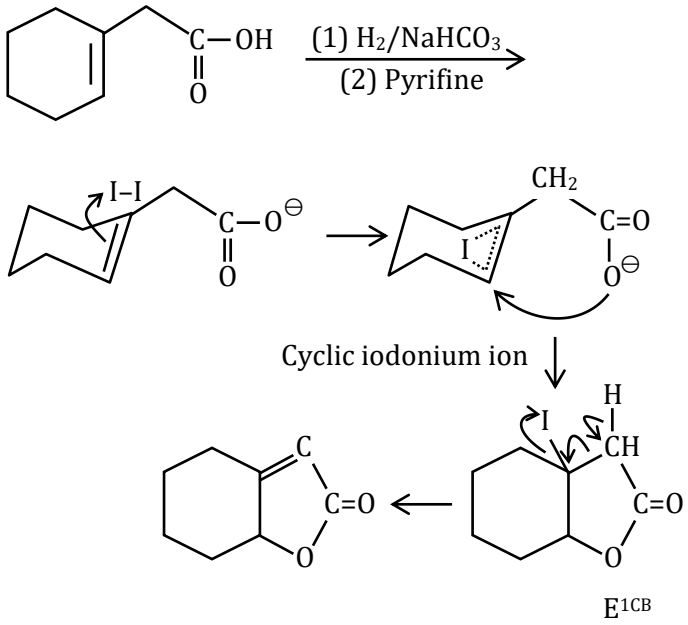
(A) 

(B) 

(C) 

(D) 

Sol. **C**



E^{1CB}

21. 2L of 0.2 M H_2SO_4 is reacted with 2L of 0.1 M NaOH solution, the molarity of the resulting product Na_2SO_4 in the solution is_____millimolar. (Nearest integer)

Sol. **25**

H_2SO_4	+	2NaOH	→	Na_2SO_4	+ $2H_2O$
M = 0.2		M = 0.1		Moles = 0.1	
V = 2 L		V = 2 L		V = 4 L	
n = M × V		n = M × V		$m = \frac{0.1}{4} \times 1000$	
= 0.2 × 2		= 0.1 × 2		**m = 25 Ans.**	
= 0.4		= 0.2			
L.R. $\frac{0.4}{1}$		$\frac{0.2}{2} = 0.1$			

$L.R. \times NaOH$

22. Metal M crystallizes into a fcc lattice with the edge length of 4.0×10^{-8} cm. The atomic mass of the metal is_____g/mol. (Nearest integer)
(Use : $N_A = 6.02\times10^{23} mol^{-1}$, density of metal, M = 9.03g cm^{-3})

Sol. **87**

$d = \frac{z\times M}{N_A \times volume}$

$9.03 = \frac{4\times M}{6.02\times10^{23}\times(4\times10^{-8})^3}$

M = 86.97 gram

$M \simeq 87$

23. If the wavelength for an electron emitted from H-atom is 3.3×10^{-10}m, then energy absorbed by the electron in its ground state compared to minimum energy required for its escape from the atom, is____times,(Nearest integer)
[Given : h = 6.626×10^{-34} J s]
Mass of electron = 9.1×10^{-31} kg

Sol. **2**

$\lambda = \frac{h}{\sqrt{2mK}}$

$K = \frac{h^2}{2m\lambda^2}$

$K = \frac{h^2}{2m\lambda^2} = \frac{43.9\times10^{-68}}{2\times9.1\times10^{-31}\times10.89\times10^{-20}}$

$K = 2.215 \times 10^{-18}$

$E_{abs} = E_{req} + K$

$\frac{E_{abe}}{E_{req}} = 1 + \frac{K}{E_{req}} = 1 + \frac{2.215\times10^{-18}}{13.6\times1.602\times10^{-19}} = 2.0166$

24. A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. Themole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is_____atm. (Nearest integer)

Sol. **2**

$P_A = P_A^0 \times X_A = P_{total} \times Y_A$

$\Rightarrow P_A^0 \times 0.2 = 0.8 \times 0.5$

$P_A^0 = 2atm$

25. AT 600K, 2 mol of NO are mixed with 1 mol of O_2.

$2NO_{(g)}+O_2(g) \rightleftarrows 2NO_2(g)$

The reaction occurring as above comes to equilibrium under a total pressure of 1 atm. Analysis of the system shows that 0.6 mol of oxygen are present at equilibrium. The equilibrium constant for reaction is _____, (Nearest integer)

Sol. **2**

	$2NO(g)$ +	$O_2(g)$	$\rightleftarrows$	$2NO_2(g)$
t=0	2 mole	1 mole		0
t=eq	1.2 mole	0.6 mole		0.8 mole

Total moles = 2.6 moles

$K_p = \frac{(P_{NO_2})^2}{(P_{NO})^2(P_{O_2})} = \frac{\left(\frac{0.8}{2.6}\times1\right)^2}{\left(\frac{1.2}{2.6}\right)^2\left(\frac{0.6}{2.6}\right)} = \frac{(0.8)^2\times2.6}{(1.2)^2\times0.6} = 1.9259$

26. A sample of 0.125g of an organic compound when analyzed by Duma's method yields 22.78 mL of nitrogen gas collected over KOH solution at 280 K and 759 mm Hg. The percentage of nitrogen in the given organic compound is_____. (Nearest integer)
Given :
(a) The vapour pressure of watter of 280 K is 14.2 mm H
(b) R = 0.082 L atm K^{-1} mol^{-1}

Sol. **22**

Pressure of nitrogen = 759 – 14.2

= 744.8 mm of Hg = 0.98 atm

Volume of moist nitrogen gas = 22.78 ml

Man of sample of organic compound = 0.125 g

T = 280 k

Mole of N_2 gas $= \frac{Pv}{RT}$

$= \frac{0.98\times22.78\times10^{-3}}{0.0821\times280}$

$= 0.97 \times {}^{10-3}$ Mole

Man of $N_2 = 0.9 \times 10^{-3} \times 28$

$= 27.16 \times 10^{-3}$ g

= 27.16 mg = 0.0276 g

% of nitrogen $= \frac{0.02716}{0.125} \times 100$

= 21.728 %

≈ 22%

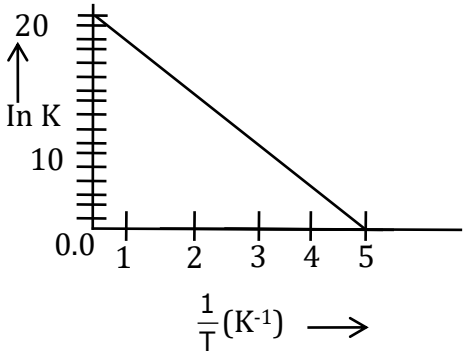
27. On reaction with stronger oxidizing agent like KIO_4, hydrogen peroxide oxidizes with the evolution of O_2. The oxidation number of I in KIO_4 changes to_____

Sol. **+5**

$H_2O_2 + \overset{+7}{K}IO_4 \rightarrow \overset{+5}{K}IO_3 + O_2 + H_2O.$

28. For a reaction, given below is the graph of ln(k) vs $\frac{1}{T}$. The activation energy for the reaction is equal to_____cal mol^{-1}. (Nearest integer)

(Given : R = 2 cal K^{-1} mo^{l-1})



Sol. **8**

$K = Ae^{-Ea/RT}$

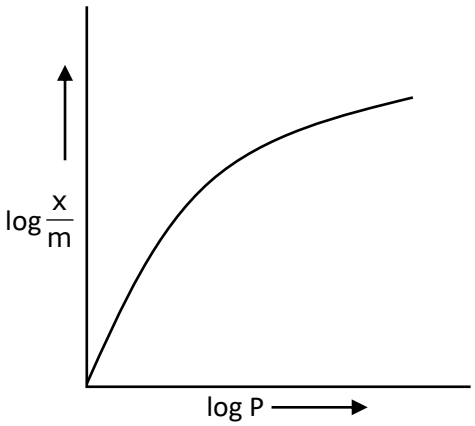
$\ln K = \ln A - \left(\frac{Ea}{R}\right)\frac{1}{T}$

Slope of graph $= \left(\frac{Ea}{R}\right) = \left(\frac{0.20}{5-0}\right)$

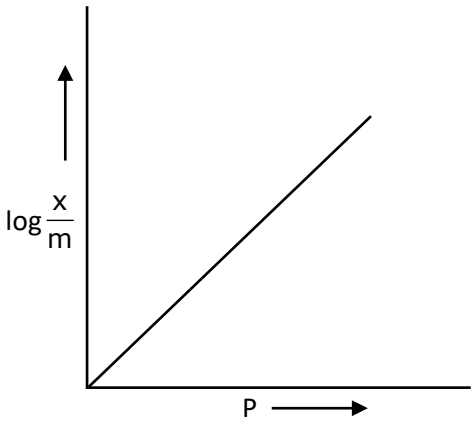
Ea = 4 × 2 = 8 cal/mole

29. Among the following the number of curves not in accordance with Freundlich adsorption isotherm is_____.

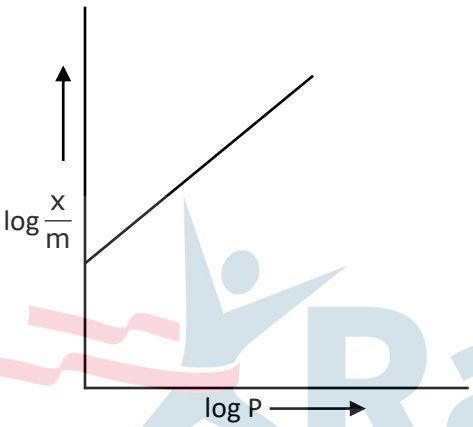
a.



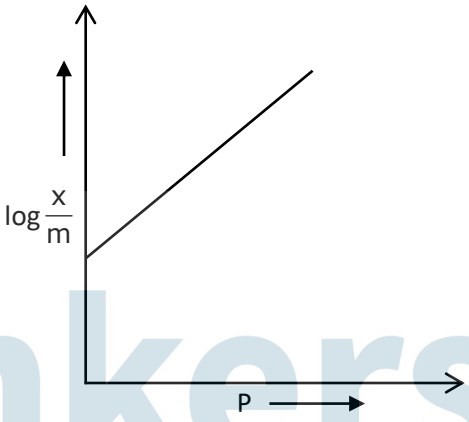
b.



c.



d.



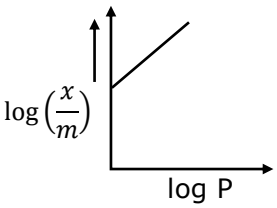
Sol. **3**

Freundlich adsorption theorem

$\frac{x}{m} = kp^{(1/n)}$

$\log\left(\frac{x}{m}\right) = \log K + \frac{1}{n}\log(P)$

graph between $\log\left(\frac{x}{m}\right)$ v/s logP



30. Among the following the number of state variables is _____.

Internal energy (U)	Volume (V)
Heat (q)	Enthalpy (H)

Sol. **3**

State variable → Volume, Enthalpy, Internal Energy

Path Variable → Heat