JEE (MAIN)-2025 (Online)

Chemistry Memory Based Answer & Solutions

MORNING SHIFT

DATE : 23-01-2025

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MEMORY BASED QUESTIONS JEE–MAIN EXAMINATION – JANUARY, 2025

(Held On Thursday 23rd January, 2025) TIME : 9 : 00 AM to 12 : 00 PM

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

1. Which of the following react with Hinsberg reagent?

(A) Aniline

(B) N,N-Dimethyl aniline

(C) Methyl amine

(D) $C_6H_5NHC_6H_5$

(1) A only (2) A and C only

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

Ans.(3)

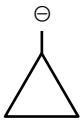
Sol. 1° & 2° Amine Reacts with Hinsberg Reagent

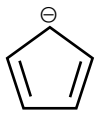
1° Amine ⟶ Soluble in dil.NaOH

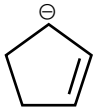
2° Amine ⟶ Insoluble in dil.NaOH

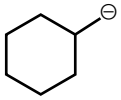
Compound A, C, & D react with Hinsberg reagent

2. Which of the following is the most stable carbanion?

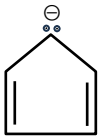
(1) 

(2) 

(3) 

(4) 

Ans. (2)

Sol. 

6π electrons so it is aromatic carbanion

(i.e. highly stable)

3. Spin only magnetic moment of octahedral complex of Co^{2+} ion is 3.84 BM. Correct electronic configuration of Co^{2+} is

(1) $t_{2g}^5 e_g^2$ (2) $t_{2g}^6 e_g^1$

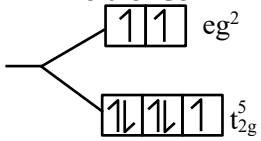
(3) $t_{2g}^6 e_g^0$ (4) $t_{2g}^3 e_g^4$

Ans. (1)

Sol. μ = 3.8 BM, so unpaired e⊖ (n) = 3

$Co^{2\oplus} \Rightarrow [Ar]3d^7$

in $Co^{2\oplus}$ complex, unpaired e⊖ = 3 will be when ligands are WFL, so d-orbital splitting under WFL field of $Co^{2\oplus}$

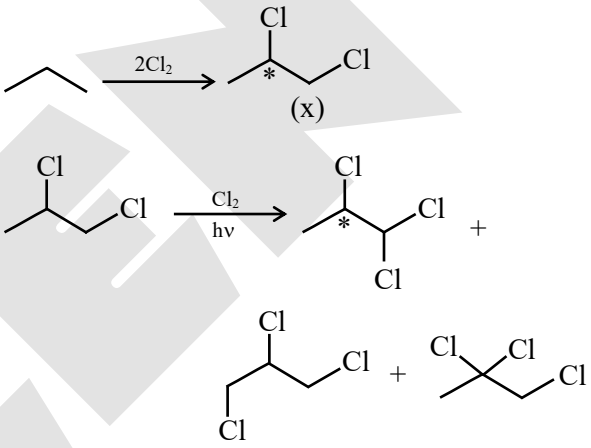


4. Dichloro product of propane will give optically active isomers [x] & optically inactive isomers [y]. Calculate total isomers when [x] reacted with Cl_2 in the presence of ultraviolet rays.

(1) 2 (2) 4

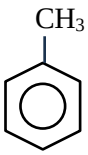
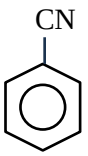
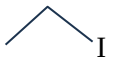
(3) 5 (4) 6

Ans. (2)

Sol. 

$2^1 = 2$ total product = $2^1 + 1 + 1 = 4$

5. Match the Column I (name of reaction) to Column II (Products).

	Column I		Column II
P.	Sandmeyer reaction	(a)	
Q.	Swartz reaction	(b)	
R.	Wurtz Fittig reaction	(c)	
S.	Finkelstein reaction	(d)	

(1) P → b, Q → d, R → a , S → c

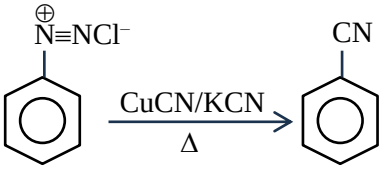
(2) P → d, Q → b, R → a , S → c

(3) P → a, Q → b, R → c , S → d

(4) P → c, Q → a, R → d , S → b

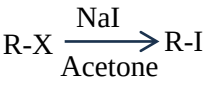
Ans. **(1)**

Sol.

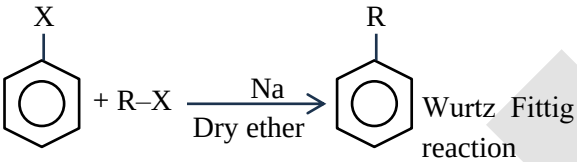


Sandmeyer reaction

Swartz reaction



Finkelstein reaction



Wurtz Fittig reaction

6. **Statement 1:** In Lassigne's test, compounds are converted from covalent form to ionic form by fusing the compound with sodium metal.

Statement 2: Nitrogen and sulphur both are present in organic compound on treated with $FeSO_4$ which gives $K_4[Fe(CN)_6]$ prussian blue colour.

(1) If both Statement-1 and Statement-2 are true and the Statement-2 is the correct explanation of the assertion.

(2) If both Statement-1 and Statement-2 are true but the Statement-2 is not the correct explanation of the assertion.

(3) If Statement-1 is true but Statement-2 is false.

(4) If the Statement-1 and Statement-2 both are false.

Ans. **(3)**

Sol. In Lassigne's test, compounds are converted from covalent form to ionic form by fusing the compound with sodium metal.

Nitrogen and carbon both are present in organic compound on treated with $FeSO_4$ which gives $Fe_4[(Fe)CN)_6]_3$ prussian blue colour.

7. Which of the following element doesn't lie in same period

(1) Osmium (2) Iridium

(3) Palladium (4) Platinum

Ans. **(3)**

Sol. Os, Ir, pt belongs to 6^{th} period

Pd > belongs to 5^{th} period

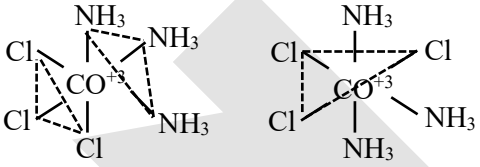
8. Which of the following complex shows facial-meridonial isomerism

(1) $[Co(NH_3)_6]$ (2) $[Co(NH_3)_3Cl_3]$

(3) $[Co(en)_2(NH_3)_2]$ (4) $[Co(H_2O)_6]Cl_3$

Ans. **(2)**

Sol. $[Co(NH_3)_3Cl_3]$



Fac-isomer Mer-isomer

Complex having formula (ma_3b_3) will show facial and meridional isomer.

9. If 10^{21} molecules are removed from x mg of $CO_2(g)$, then 2.8×10^{-3} moles are left. Calculate the value of x

(1) 153.3 (2) 196.28

(3) 54.36 (4) 86.2

Ans. **(2)**

Sol. Total moles of CO_2 = moles removed + moles left

$$\frac{x \times 10^{-3}}{44} = \frac{10^{21}}{6.02 \times 10^{23}} + 2.8 \times 10^{-3}$$

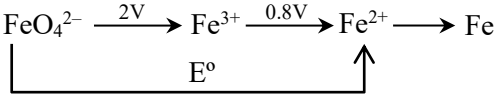
$$\frac{x \times 10^{-3}}{44} = \frac{10 \times 10^{-3}}{6.02} + 2.8 \times 10^{-3}$$

$$\frac{x}{44} = \frac{10}{6.02} + 2.8$$

$$x = \left(\frac{10 + 2.8 \times 6.02}{6.02}\right) \times 44$$

$= 196.28$ mg

10.



(1) 2V (2) 1.7 V

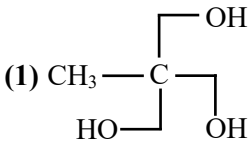
(3) 1.5 V (4) 1 V

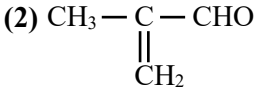
Ans. **(2)**

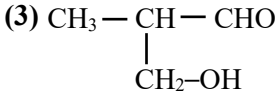
Sol. $(2 \times 3) + (0.8 \times 1) = 4 \times E°$

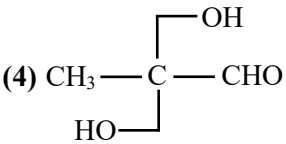
$E° = 1.7$ V

11. $CH_3CH_2CH{=}O \xrightarrow[\text{Excess}]{HCHO,\overset{\ominus}{O}H} [A]$

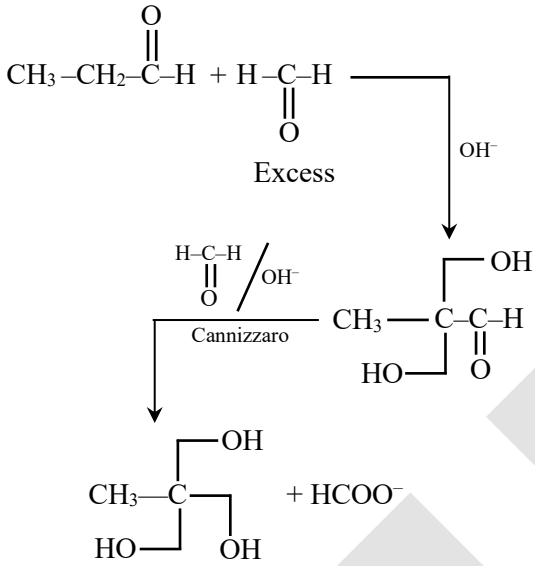
(1) 

(2) 

(3) 

(4) 

Ans. (3)

Sol. 

Two times cross aldol and next cross Cannizzaro

12. Statement 1: Fructose can give tollens test even though it does not have aldehyde group.

Statement 2: When reacted with base fructose can undergo rearrangement to produce aldehyde group.

(1) If both Statement-1 and Statement-2 are true and the Statement-2 is the correct explanation of the assertion.

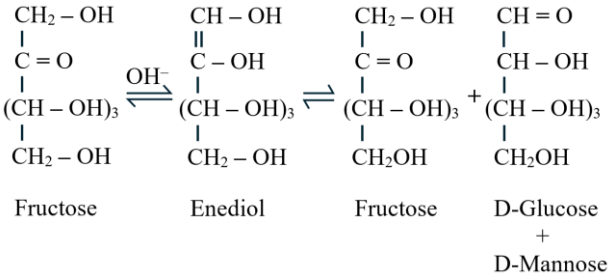
(2) If both Statement-1 and Statement-2 are true but the Statement-2 is not the correct explanation of the assertion.

(3) If Statement-1 is true but Statement-2 is false.

(4) If the Statement-1 and Statement-2 both are false.

Ans. (1)

Sol. Fructose is a reducing sugar. In basic medium it tautomerises to give an equilibrium between fructose, D-Glucose & D-mannose.



Fructose | Enediol | Fructose | D-Glucose + D-Mannose

13. The stability order of following compound is?

(I) (II) (III)

(1) II > I > III (2) I > II > III

(3) III > II > I (4) III > I > II

Ans. (3)

Sol. Compound III is Aromatic Compound II is non-aromatic and compound I is antiaromatic.

So Correct stability order is III > II > I

14. Compound $Co(NH_3)_xCl_3$ has 0.1 molal concentration and is 100% dissociated Given : $\Delta T_f = 0.558°C$

$k_f = 1.86$.

The formula of compound is _____.

(1) $[Co(NH_3)_3Cl_3]$ (2) $[Co(NH_3)_2Cl_4]$

(3) $[Co(NH_3)_5Cl]Cl_2$ (4) None

Ans. (3)

Sol. $[\Delta T_f] = i \times k_f \times m$

$0.558 = i \times 1.86 \times 0.1$

$i = 3$

$[Co(NH_3)_5Cl]Cl_2 \xrightarrow{\alpha=100\%} [Co(NH_3)_5Cl]^{2+} + 2Cl^-$

[i = 3]

15. In which of the following electronic transition in H-atom photon of 900 nm wavelength is evolved? ($R_H = 10^5\ cm^{-1}$)

(1) n = ∞ to n = 1 (2) n = ∞ to n = 2

(3) n = 5 to n = 1 (4) n = ∞ to n = 3

Ans. (4)

Sol. $\frac{1}{\lambda} = R_H \times Z^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$\frac{1}{\lambda} = 10^5 \times (1)^2 \left[\frac{1}{3^2} - \frac{1}{\infty^2}\right]$

$\frac{1}{\lambda} = 10^5 \times \frac{1}{9}$

$\lambda = 9 \times 10^{-5}$ cm $= 9 \times 10^{-7}$ m $= 900$ nm

16. Incorrect statement among the following is

(1) SO_2 act as oxidising agent but not reducing agent.

(2) NO_2 exists as dimer

(3) PF_5 exists but NF_5 does not

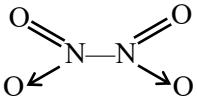
(4) PH_3 has lower proton affinity than NH_3

Ans. **(1)**

Sol. (1) SO_2 is in '+4' oxidation state (intermediate ox. state).

So can act or both oxidising & reducing agent.

(2) $NO_2 \longrightarrow N_2O_4$



(3) NF_5 does not exist due to unavailability of 2d-orbitals.

(4) In PH_3, lone pair is present in pure s-orbital. (Drago's Rule) which is more attracted towards nucleus of phosphorus. That's why PH_3 has lower proton affinity than NH_3.

17. In a solution 1M A^{+2} and 1M B^{+3} are present and NH_4OH solution is added slowly into it then which will get precipitate first?

$(K_{sp})_{A(OH)_2} = 9 \times 10^{-10}$

$(K_{sp})_{B(OH)_3} = 27 \times 10^{-18}$

(1) Both precipitate simultaneously

(2) $A(OH)_2$ precipitate first and $B(OH)_3$ will precipitate later.

(3) $B(OH)_3$ precipitate first and $A(OH)_2$ will precipitate later.

(4) Both are not precipitate

Ans. **(3)**

Sol. $A(OH)_2 \rightleftharpoons A^{+2} + 2OH^-$

$K_{sp} = [A^{+2}][OH^-]^2$

$9 \times 10^{-10} = 1 \times [OH^-]^2$

$[OH^-] = 3 \times 10^{-5}$ M

$B(OH)_3 \rightleftharpoons A^{+3} + 3OH^-$

$K_{sp} = [B^{+3}][OH^-]^3$

$27 \times 10^{-18} = 1 \times [OH^-]^3$

$[OH^-] = 3 \times 10^{-6}$ M

$B(OH)_3$ will precipitate first.

18.

	Match-1		**Match-2**
(A)	Incomplete octet	(P)	BCl_3, $AlCl_3$
(B)	Extended octet	(Q)	H_2SO_4, SO_2
(C)	Odd electronic species	(R)	NO, NO_2
(D)	Complete octet	(S)	CO_2, PCl_3

(1) A-P, B-Q, C-R, D-S

(2) A-Q, B-P, C-R, D-S

(3) A-R, B-Q, C-P, D-S

(4) A-S, B-P, C-Q, D-R

Ans. **(1)**

Sol. (P) BCl_3, $AlCl_3$ → Hypovalent species (Incomplete octet)

(Q) H_2SO_4, SO_2 → Hypervalent species (Extended octet)

(R) NO, NO_2 → Odd electron species

(S) CO_2, PCl_3 → Complete octet.

(A) → (P)

(B) → (Q)

(C) → (R)

(D) → (S)

19. Which of the following pair of aquated transition metal ions are same coloured?

(1) Ti^{4+}, V^{3+}

(2) Cr^{2+}, Cu^{2+}

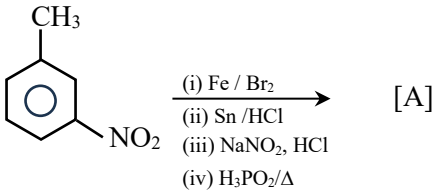
(3) Cr^{3+}, Ni^{2+}

(4) Mn^{3+}, Fe^{2+}

Ans. **(2)**

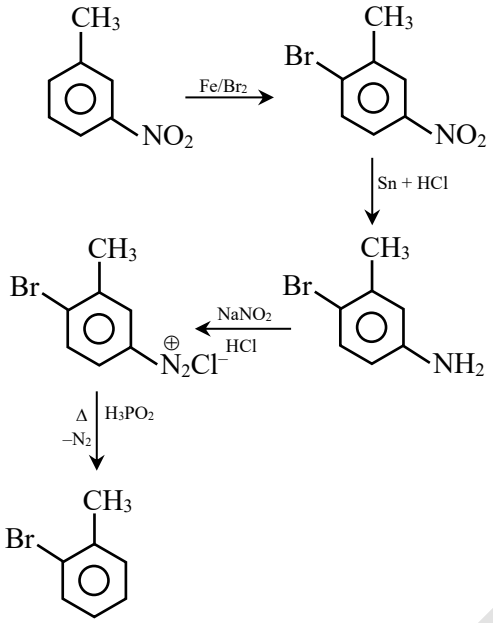
Sol. Ti^{4+}- colourless, V^{3+}-green , Cr^{2+}-blue , Cu^{2+}-blue, Cr^{3+}-violet, Ni^{2+}-green, Mn^{3+}-violet, Fe^{2+}-green

SECTION-B

20. 

Determine the molecular weight of product A?

Ans. (171)

Sol. 

$C_7H_7Br \rightarrow 84 + 7 + 80 = 171$

Ans. 171

21. Consider the given values :

$\Delta H = 55$ kJ mol^{-1}

$\Delta S = 175$ J mol^{-1} K^{-1}

$T = 25°C$

Calculate the value of Gibbs free energy change (ΔG) in J mol^{-1}.

Ans. (3)

Sol. Gibbs free energy change

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

$= 55 \times 10^3$ (J/mol) – 298 (k) × 175 (J/mol.k)

$= 55000 - 52150$

$= 2850$ J/mol

22. Calculate the percentage by weight of Sulphur if 160 gram of organic compound produces 466 gram of $BaSO_4$. (Atomic mass of Ba = 137)

Ans. (40)

Sol. $\underset{\text{(Containing sulphur)}}{O.C} \longrightarrow BaSO_4$

wt $\Rightarrow$ 160 gm 466 gm

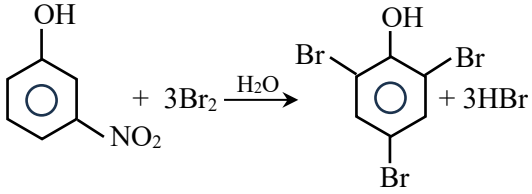
mole of $BaSO_4 = \frac{466}{233} = 2$

$\Rightarrow$ mole of Sulphur = 2 (by P.O.A.C)

$\Rightarrow$ mass % of Sulphur = $\frac{2\times32}{160} \times 100 = 40$

23. If 2 gm phenol is allowed to react with Br_2/H_2O. How much Br_2 will be required to produce 2, 4, 6-tribromophenol (Rounded off to nearest integer).

Ans. (10)

Sol. 

M_W of phenol = $C_6H_6O = 94$

Br_2 required = $\frac{2}{94} = 0.02127\times3\times160 = 10.21 \simeq 10$

Ans. 10

24. 1 millimolar aq. solution of ethylamine has pH = 9, its $K_b = 10^{-x}$ Value of x is?

Ans. (7)

Sol. Ethylamine (C_2H_5)

$C_2H_5NH_2 + H_2O \rightarrow C_2H_5NH_3^+ + OH^-$

$[OH^-] = \sqrt{k_b \times c}$ pH = 9

$10^{-5} = \sqrt{k_b \times 10^{-3}}$ POH = 5

$k_b = \frac{10^{-10}}{10^{-3}}$ $[OH^-] = 10^{-5}$

$k_b = 10^{-7}$ x = 7

25. For a 1st order reaction

$2N_2O_5(g) \rightarrow 2N_2O_4(s) + O_2(g)$

Time (sec)	0	100 sec
Total pressure	0.6 atm	X atm

Calculate value of x ($k = 4.606 \times 10^{-2}$)

Ans. (0.897 atm)

Sol.

	$2N_2O_5(g)$	$\longrightarrow 2N_2O_4(g)$	+ $O_2(g)$
t = 0	0.6	0	0
t = 100 se	0.6–2P	2P	P
t_∞	—	0.6 atm	0.3 atm

For gaseous reaction

$k = \frac{1}{t}\ln\frac{P_\infty - P_0}{P_\infty - P_t}$

$4.606 \times 10^{-2} = \frac{2.303}{100}\log\frac{0.9-0.6}{0.9-P_t}$

$P_t = 0.897$ atm