CHEMISTRY
JEE-MAIN (July-Attempt)
25 July (Shift-1) Paper Solution

(SECTION - A)

1. SO_2Cl_2 on reaction with excess of water results into acidic mixture

$SO_2Cl_2 + 2H_2O \longrightarrow H_2SO_4 + 2HCl$

16 moles of NaOH is required for the complete neutralization of the resultant acidic mixture. The number of moles of SO_2Cl_2 used is:

(A) 16 (B) 8 (C) 4 (D) 2

Sol. **C**

$SO_2Cl_2 + 2H_2O \longrightarrow H_2SO_4 + 2HCl$

a mole a mole 2a mole

(i) $H_2SO_4 + 2NaOH \longrightarrow Na_2SO_4 + 2H_2O$

a mole 2a mole

Total mole of NaOH required = 4a = 16

a = 4

2. Which of the following sets of quantum numbers is not allowed?

(A) n = 3, l = 2, m_1 = 0, s + $\frac{1}{2}$ (B) n = 3, l = 2, m_1 = –2, s + $\frac{1}{2}$

(C) n = 3, l = 3, m_1 = –3, s – $\frac{1}{2}$ (D) n = 3, l = 0, m_1 = 0, s – $\frac{1}{2}$

Sol. **C**

For n = 3 $\Rightarrow$ only 3s, 3p & 3d

$\downarrow$

$\ell = 0$ $\ell = 1$ $\ell = 2$

$\ell = 3$ not possible

3. The depression in freezing point observed for a formic acid solution of concentration 0.5 mL L^{-1} is 0.0405°C. Density of formic acid is 1.05 g mL^{-1}. The Van't Hoff factor of the formic acid solution is nearly: (Given for water k_f = 1.86 k kg mol^{-1})

(A) 0.8 (B) 1.1 (C) 1.9 (D) 2.4

Sol. **C**

Conc of formic acid = 0.5 ml/lit.

ΔT_f = 0.0405

Density = 1.05 gm/ml

$D = \frac{mass}{v} \Rightarrow 1.05 = \frac{mass}{0.5}$

Mass of HCOOH = 1.05 × 0.5 = 0.525 gm/lit

Molarity = $\frac{0.525}{46}$ moles/lit.

$\Rightarrow \Delta T_f = i \times k_f \times$ molality = 0.0405 = i × 1.86 × $\frac{0.525}{46}$

$i = \frac{0.0405 \times 46}{1.86 \times 0.525} = 1.9$

4. 20 mL of 0.1 M NH_4OH is mixed with 40 mL of 0.05 M HCl. The pH of the mixture is nearest to:
(Given: $K_b(NH_4OH) = 1 \times 10^{-5}$, log 2 = 0.30, log 3 = 0.48, log 5 = 0.69, log 7 = 0.84, log 11 = 1.04)
(A) 3.2 (B) 4.2 (C) 5.2 (D) 6.2

Sol. **C**

	NH_4OH	+	HCl	$\longrightarrow$	NH_4Cl	+	H_2O
m.moles	20×0.1		40×0.05		↓		
	2		2		2 m.moles		
	0		0		$[NH_4Cl] = \frac{2}{60} = \frac{1}{30}$		

$P^{OH} = \frac{1}{2}[P^{kw} + P^{kb} + \log C]$

$= \frac{1}{2}[14 + 5 + \log \frac{1}{30}]$

$= \frac{1}{2}[19 - 1 - 0.4771]$

$= \frac{1}{2}[18 - 0.4771]$

$= 9 - 0.23$

$P^H = 5 + 0.23$

5. Match List – I with List-II

List – I	List – II
(A) $N_2(g) + 3H_2(g) \rightarrow 2NH_3(g)$	(I) Cu
(B) $CO(g) + 3H_2(g) \rightarrow CH_4(g) + H_2O(g)$	(II) $Cu/ZnO - Cr_2O_3$
(C) $CO(g) + H_2(g) \rightarrow HCHO(g)$	(III) $Fe_xO_y + K_2O + Al_2O_3$
(D) $CO(g) + 2H_2(g) \rightarrow CH_3(OH)(g)$	(IV) Ni

Choose the correct answer from the options given below:
(A) (A)-(II), (B)-(IV), (C)-(I), (D)-(III) (B) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(C) (A)-(III), (B)-(IV), (C)-(I), (D)-(II) (D) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

Sol. **C**

$N_2(g) + 3H_2(g) \xrightarrow{Fe_xO_y+K_2O+Al_2O_3} 2NH_3(g)$

$CO(g) + 3H_2(g) \xrightarrow{Ni} CH_4(g) + H_2O(g)$

$CO(g) + H_2(g) \xrightarrow{Cu} HCHO(g)$

$CO(g) + 2H_2(g) \xrightarrow{Cu/ZnO-Cr_2O_3} CH_3(OH)(g)$

6. The IUPAC nomenclature of an element with electronic configuration [Rn] $5f^{14}6d^17s^2$ is:
(A) Unnilbium (B) Unnilunium (C) Unnilquadium (D) Unniltrium

Sol. **D**

Atomic no = 103 (Unt)

7. The compound(s) that is(are) removed as slag during the extraction of copper is:

(A) CaO (B) FeO (C) Al_2O_3 (D) ZnO (E) NiO

Choose the correct answer from the option given below:

(A) (C), (D) only (B) (A), (B), (E) only

(B) (A), (B) only (D) (B) only

Sol. **D**

Copper pyrite has Impurity of FeO

$$\underset{\text{Imp.}}{FeO} + \underset{Flux}{SiO_2} \longrightarrow \underset{Sag}{FeSiO_3}$$

8. The reaction of H_2O_2 with potassium permanganate in acidic medium leads to the formation of mainly:

(A) Mn^{2+} (B) Mn^{4+} (C) Mn^{3+} (D) Mn^{6+}

Sol. **A**

$$H_2O_2 + H_2SO_4 + KMnO_4 \longrightarrow KMnO_4 + O_2 + K_2SO_4\ H_2O$$

9. Choose the correct order of density of the alkali metals:

(A) Li < K < Na < Rb < Cs (B) Li < Na < K < Rb < Cs

(C) Cs < Rb < K < Na < Li (D) Li < Na < K < Cs < Rb

Sol. **A**

K has lower density than Na – due to large size

10. The geometry around boron in the product 'B' formed from the following reaction is

$$BF_3 + NaH \xrightarrow{450\ K} A + NaF$$

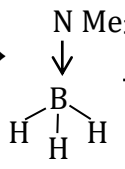
$$A + NMe_3 \rightarrow B$$

(A) trigonal planar (B) tetrahedral (C) pyramidal (D) square planar

Sol. **B**

$$BF_3 + NaH \xrightarrow{450\ K} B_2H_6 + NaF$$

$$B_2H_6 + NMe_3 \rightarrow \underset{\downarrow}{\overset{N\ Me_3}{}} \rightarrow sp^3\text{(tetrahedral)}$$



11. The interhalogen compound formed from the reaction of bromine with excess of fluorine is a:

(A) hypohalite (B) halate (C) perhalate (D) halite

Sol. **B**

$$Br_2 + \underset{excess}{5F_2} \longrightarrow 2BrF_5$$

$$BrF_5 + 3H_2O \longrightarrow HBrO_3 + 5HF$$

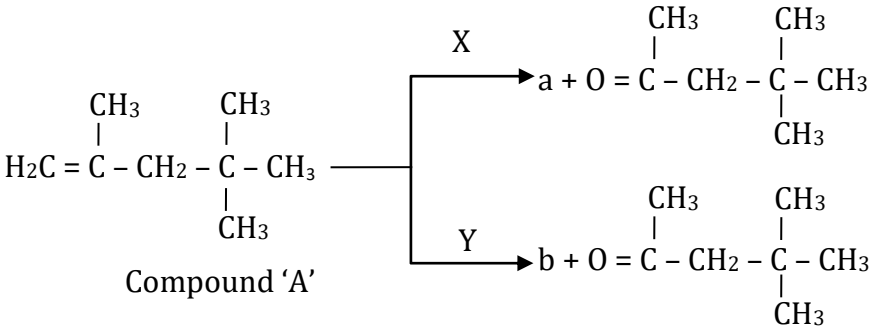
12. The photochemical smog does not generally contain:

(A) NO (B) NO_2 (C) SO_2 (D) HCHO

Sol. **C**

The common components of photochemical smog are ozone, nitric oxide, acrolein, formeldehyde and PAN

13. A compound 'A' on reaction with 'X' and 'Y' produces the same major product but different by product 'a' and 'b'. Oxidation of 'a' gives a substance produce by ants.

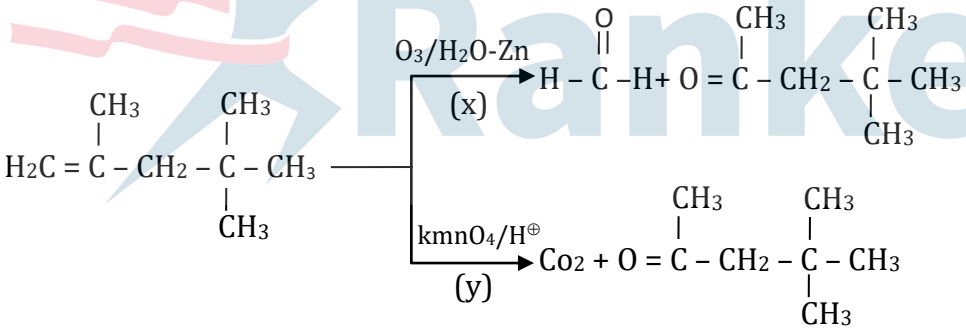


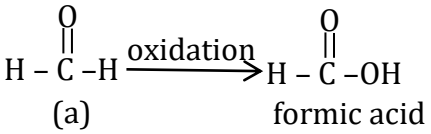
'X' and 'Y' respectively are

(A) $KMnO_4/H^+$ and dil. $KMnO_4$, 273 K (B) $KMnO_4$(dilute), 273 K and $KMnO_4/H^+$

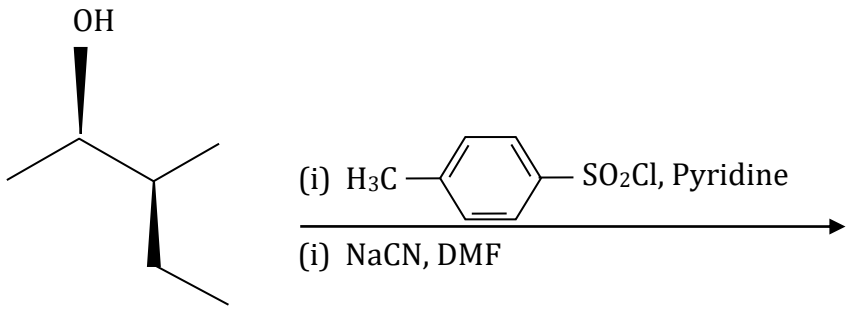
(C) $KMnO_4/H^+$ and O_3, H_2O/Zn (D) O_3, H_2O/Zn and $KMnO_4/H^+$

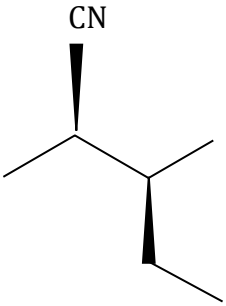
Sol. **D**

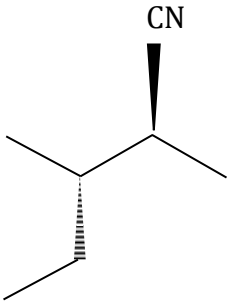


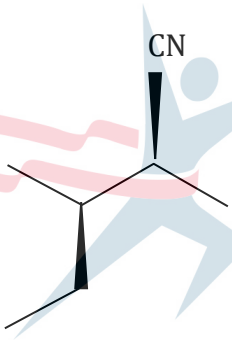


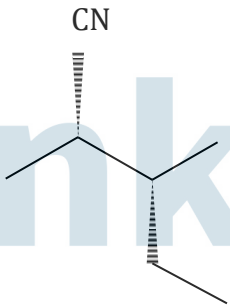
14. Most stable product of the following reaction is:



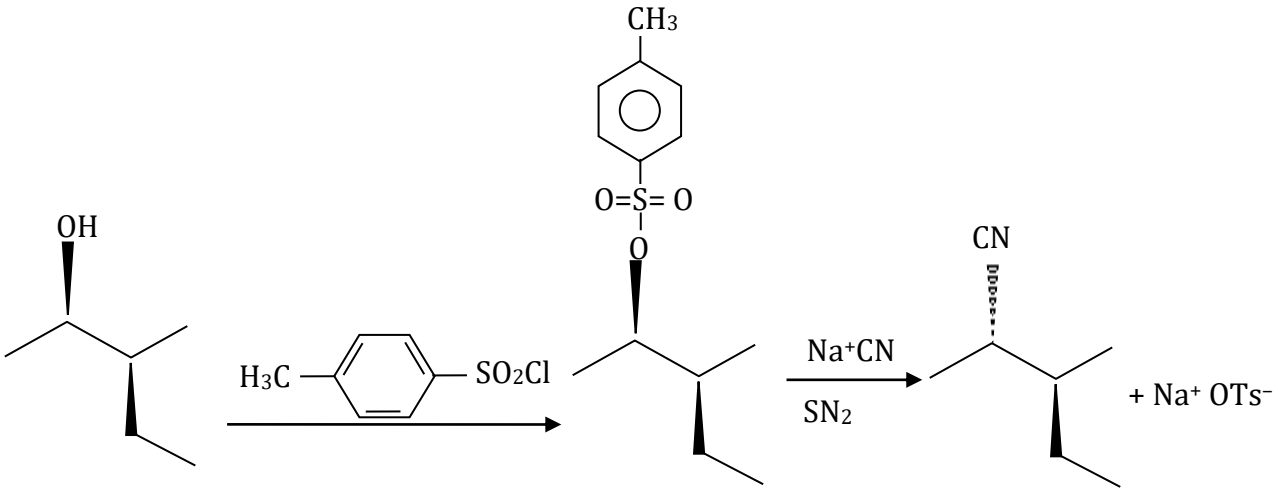
(A) 

(B) 

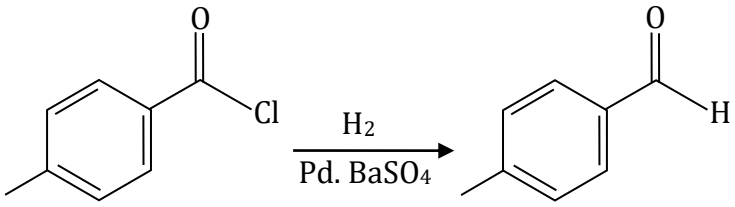
(C) 

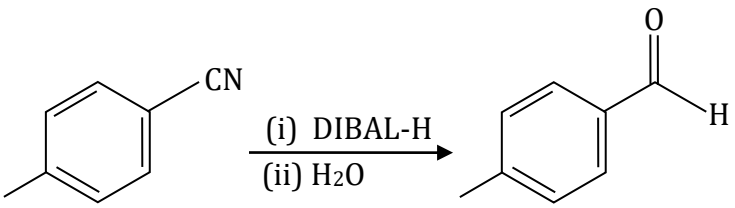
(D) 

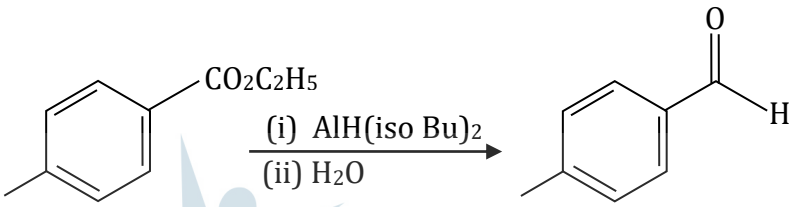
Sol. **B**

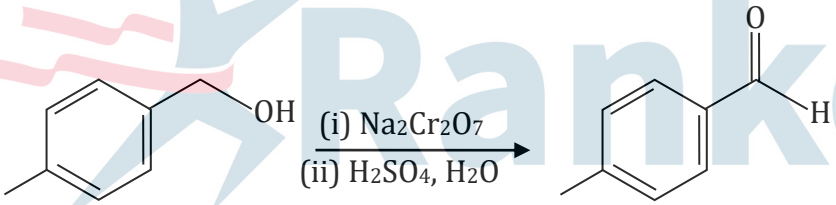


15. Which one of the following reactions does not represent correct combination of substrate and product under the given conditions?

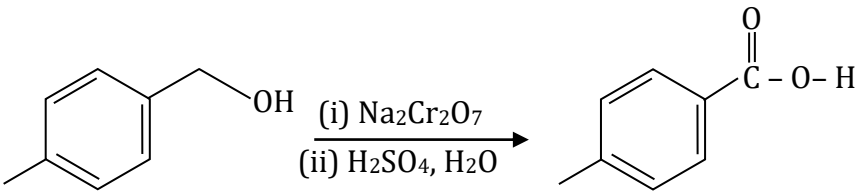
(A) 

(B) 

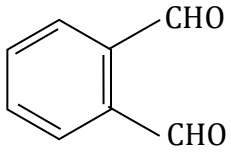
(C) 

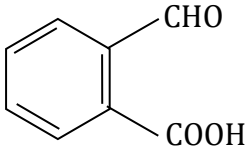
(D) 

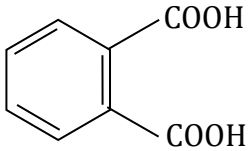
Sol. **D**

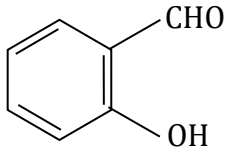


16. An organic compound 'A' on reaction with NH_3 followed by heating gives compound B. Which one further strong heating gives compound C ($C_8H_5NO_2$). Compound C on sequential reaction with ethanolic KOH, alkyl chloride and hydrolysis with alkali gives a primary amine. The compound A is:

(A) 

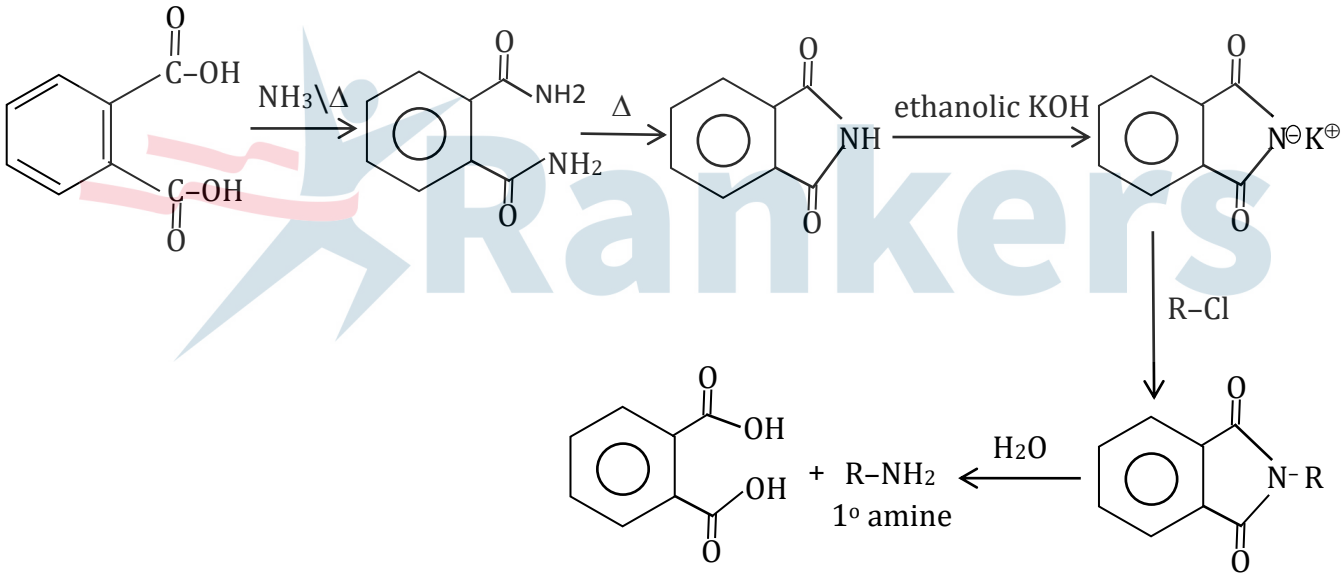
(B) 

(C) 

(D) 

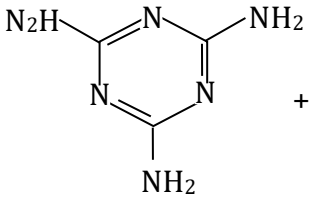
Sol. **C**

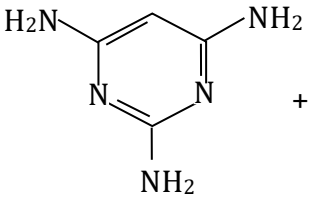
A

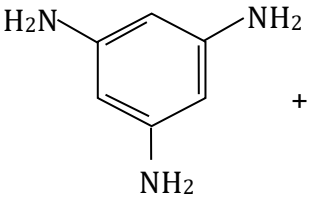


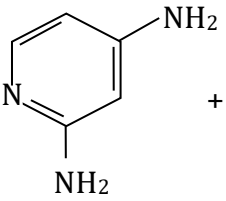
Gabrial pthalimide reaction

17. Melamine polymer is formed by the condensation of:

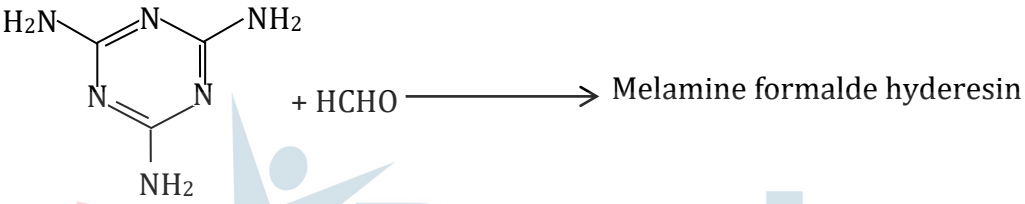
(A)  + HCHO

(B)  + HCHO

(C)  + HCHO

(D)  + HCHO

Sol. **A**



18. During the denaturation of proteins, which of these structures will remain intact?

(A) Primary (B) Secondary (C) Tertiary (D) Quaternary

Sol. **A**

19. During used to bind to receptors, inhibiting its natural function and blocking a message are called:

(A) Agonists (B) Antagonists (C) Allosterists (D) Anti histaminists

Sol. **B**

20. Given below are two statements:

Statement I: On heating with $KHSO_4$, glycerol is dehydrated and acrolein is formed.

Statement II: Acrolein has fruity odour and can be used to test glycerol's presence.

Choose the correct option.

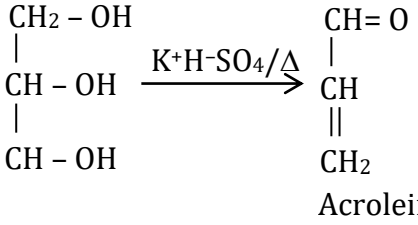
(A) Both Statement I and Statement II are correct

(B) Both Statement I and Statement II are incorrect

(C) Statement I is correct but Statement II is incorrect

(D) Statement I incorrect but Statement II is correct

Sol. **C**



Acrolein

Acrolein does not have fruity oclour.

SECTION - B

21. Among the following species

N_2, N_2^+, N_2^-, O_2, O_2^+, O_2^-, O_2^{2-}

The number of species showing diamagnesim is _____.

Sol. **2**

Diagmagnetic species are N_2, O_2^{2-}.

22. The enthalpy of combustion of propane, graphite and dihydrogen at 298 K are –2220.0 kJ mol^{-1}, –393.5 kJ mol^{-1} and –285.8 kJ mol^{-1} respectively. The magnitude of enthalpy of formation of propane (C_3H_8) is _____ kJ mol^{-1}. (Nearest integer)

Sol. **104**

$C_3H_8 + 5O_2 \longrightarrow 3CO_2 + 4H_2O$

$\Delta H°_c = 3\Delta H°_f CO_2 + 4\Delta H°_f H_2O - \Delta H_f C_3H_8$

$-2220 = 3(-393.5) + 4(-285.8) - x$

$-2220 = -1180.5 - 1143.2 - x$

$x = -2323.7 + 2220$

$= 103.7$

$= 104$ kJ

23. The pressure of a moist gas at 27°C is 4 atm. The volume of the container is doubled at the same temperature. The new pressure of the moist gas is _____ × 10^{-1} atm. (Nearest integer)
(Given: The vapour pressure of water at 27°C is 0.4 atm)

Sol. **2.2**

Press. of moist = 4 atm

Press .of gas = 4 – v.p of H_2O

= 4 – 0.4

= 3.6

When volume is doubled $\Rightarrow$ P = P/2

$= \frac{3.6}{2} = 1.8$

Total Press. = 1.8 + v.p of H_2O

= 1.8 + 0.4 = 2.2 atm

24. The cell potential for $Zn|Zn^{2+}(aq)||Sn^{x+}|$ Sn is 0.801 V at 298K. The reaction quotient for the above reaction is 10^{-2}. The number of electrons involved in the given electrochemical cell reaction is _____.

(Given: $E^0_{Zn^{2+}|Zn} = 0.763V$, $E^0_{Sn^{x+}|Sn} = +0.008V$ and $\frac{2.303RT}{F} = 0.06V$)

Sol. **4**

$Zn|Zn^{+2}||Sn^{+x}|Sn$

$E = 0.081V, \quad q = 10^{-2}$

$0.081 = E° - \frac{0.0591}{n} \log Q$

$0.801 = 0.771 - \frac{0.66}{n} \log 10^{-2}$

$0.03 = \frac{-0.06 \times -2}{n} = \frac{0.12}{n}$

$N = 0.12/0.03 = 4$

Total e^- trensfer = 4

25. The half life for the decomposition of gaseous compound A is 240 s when the gaseous pressure was 500 Torr initially. When the pressure was 250 Torr, the half life was found to be 4.0 min. The order of the reaction is _____. (Nearest integer)

Sol. **1**

$t\frac{1}{2} = 240$ sec, $\quad p° = 500$ torr

$t\frac{1}{2} = 4$ min $\quad p° = 250$ torr

$= 4 \times 60 = 240$ sec

Order = 1, $t_{\frac{1}{2}}$ is independent of initial press.

26. Consider the following metal complexes:

$[Co(NH_3)_6]^{3+}$

$[CoCl(NH_3)_5]^{2+}$

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

$[Co(NH_3)_5(H_2O)]^{3+}$

The spin-only magnetic moment value of the complex that absorbes light with shortest wavelength is _____ B.M. (Nearest integer)

Sol. **0**

$[Co(CN)_6]^{3-}$ absorbes light with shortest wave length because CN^- is SFL so more spliting takes place and t_2g and eg orbital have more energy diffence.

27. Among Co^{3+}, Ti^{2+}, V^{2+} and Cr^{2+} ions, one if used as a reagent cannot liberate H_2 from dilute mineral acid solution, its spin-only magnetic moment in gaseous state is _____ B.M. (Nearest integer)

Sol. **5**

Co^{+3} has more value of SRP so it cannot liberate H_2 from dilute acid solution.

28. While estimating the nitrogen present in an organic compound by Kjeldahl's method, the ammonia evolved from 0.25g of the compound neutralized 2.5 mL of 2 M H_2SO_4. The percentage of nitrogen present in organic compound is _____.

Sol. **56**

M_{eq} of $H_2SO_4 = 2.5 \times 2 \times 2$

$= 10 = m_{eq}$ of NH_3

m. moles of $NH_3 = m_{eq}$ of NH_3 [nf = 1]

$= 10$

m. moles of N = 10, moles of $N = 10 \times 10^{-3}$

wt. of $N = 10^{-2} \times 14 = 0.14$ gm

% of $N = \frac{0.14}{0.25} \times 100 = 56\%$

29. The number of sp^3 hybridised carbons in an acyclic neutral compound with molecular formula C_4H_5N is _____.

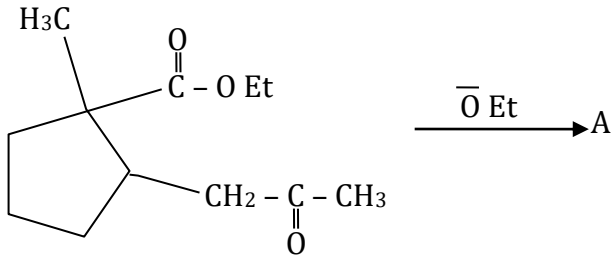
Sol. **1**

C_4H_5N

$$CH_3 - CH = CH - C \equiv N$$

DOU = 3

30. In the given reaction



(Where Et is $-C_2H_5$)

The number of chiral carbon/s in product A is _____.

Sol. **2**