PART : CHEMISTRY

SECTION-1 : 12 Marks

- This section contains **FOUR (04)** questions.
- Each question has FOUR options (A), (B), (C) and (D). **ONLY ONE** of these four options is the correct answer.
- For each question, choose the option corresponding to the correct answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks ~~: **+3** If ONLY the correct option is chosen;~~
Zero Marks : **0** If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : **−1** In all other cases.

1. A closed vessel contains 10 g of an ideal gas X at 300 K, which exerts 2 atm pressure. At the same temperature, 80 g of another ideal gas Y is added to it and the pressure becomes 6 atm. The ratio of root mean square velocities of X and Y at 300 K is

(A) 2 2 : 3 (B) 2 2 : 1 (C) 1 : 2 (D) 2 : 1

Ans. **(D)**

Sol. Given ,

$W_X = 10g$

$P_X = 2$ atm

$W_Y = 80g$

$P_Y = P_{total} - P_X$

$\Rightarrow 6 - 2 = 4$ atm

As $V_{rms} = \frac{3RT}{M}$

$$\frac{(V_{rms})_X}{(V_{rms})_Y} = \frac{M_Y}{M_X} \quad .....(1)$$

As we know,

$PV = nRT$

Volume and temperature remains same

$$P_X V = \frac{W_X}{M_X} RT \quad .....(2)$$

$$P_Y V = \frac{W_Y}{M_Y} RT \quad .....(3)$$

From (1) , (2) and (3)

$$\frac{(V_{rms})_X}{(V_{rms})_Y} = \frac{W_Y}{P_Y} \cdot \frac{P_X}{W_X} = \frac{80}{4} \times \frac{2}{10} = 4 = \frac{2}{1} = 2:1$$

2. At room temperature, disproportionation of an aqueous solution of in *situ* generated nitrous acid (HNO_2) gives the species

(A) H_3O^+, NO_3^- and NO (B) H_3O^+, NO_3^- and NO_2

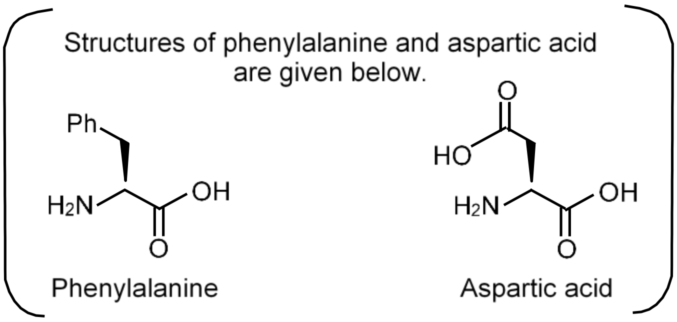
(C) H_3O^+, NO^- and NO_2 (D) H_3O^+, NO_3^- and N_2O

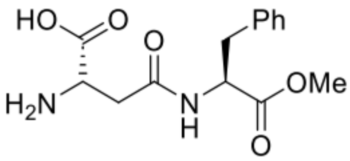
Ans. **(A)**

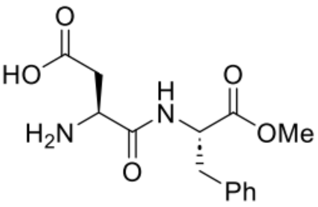
Sol. $HNO_2(aq) \rightarrow HNO_3 + NO + H_2O$ or in ionic form $NO_2^- \rightarrow NO_3^- + H_3O^+ + NO$

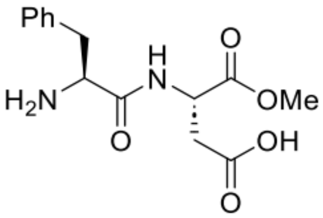
HNO_2 is unstable and gets disproportionation as above

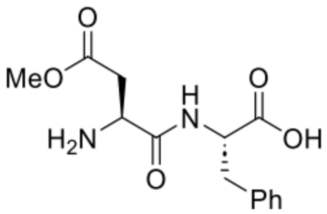
3. Aspartame, an artificial sweetener, is a dipeptide aspartyl phenylalanine methyl ester. The structure ofaspartame is



(A) 

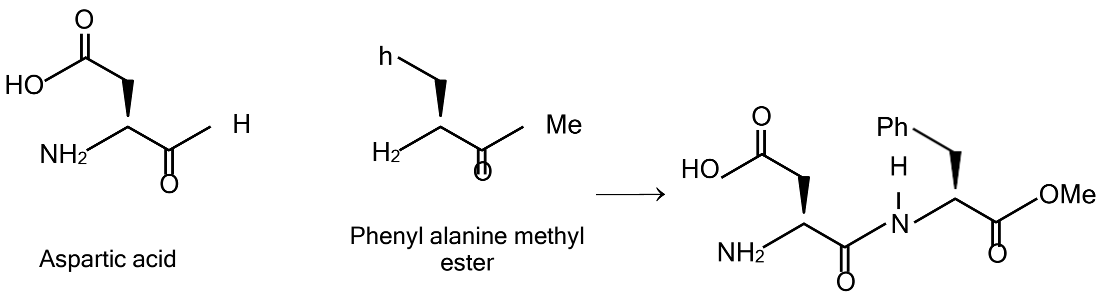
(B) 

(C) 

(D) 

Ans. **(B)**

Sol. In the given dipeptide parent amino acid is phenyl alanine



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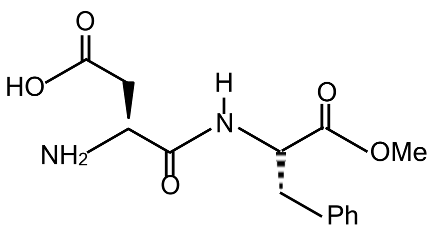


4. Among the following options, select the option in which each complex in **Set-I** shows geometrical isomerism and the two complexes in **Set-II** are ionization isomers of each other.
[en = $H_2NCH_2CH_2NH_2$]

(A) **Set-I :** $[Ni(CO)_4]$ and $[PdCl_2(PPh_3)_2]$
Set-II : $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5(SO_4)]Cl$

(B) **Set-I :** $[Co(en)(NH_3)_2Cl_2)]$ and $[PdCl_2(PPh_3)_2]$
Set-II : $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6)]$

(C) **Set-I :** $[Co(NH_3)_3(NO_2)_3]$ and $[Co(en)_2Cl_2]$
Set-II : $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5](SO_4)]Cl$

(D) **Set-I :** $[Cr(NH_3)_5Cl]Cl_2$ and $[Co(en)(NH_3)_2Cl_2]$
Set-II : [~~Cr(H~~$_2$O)$_6$Cl$_3$ and $[Cr(H_2O)Cl]Cl_2.H_2O$

Ans. **(C)**

Sol. **Set-I :** $[Co(NH_3)_3(NO_2)_3]$ and $[Co(en)_2Cl_2]$,
(i) $[Co(NH_3)_3(NO_2)_3]$ is of type $[Ma_3b_3]$ and will show two geometric isomers fac and mer
(ii) $[Co(en)_2Cl_2]$ is of type $[M(AA)_2a_2]$ and will show two geometric isomers cis and trans

Set-II : $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5](SO_4)]Cl$ exhibits ionisation isomerism

SECTION 2 : 12 Marks

- This section contains **THREE (03)** questions.
- Each question has **FOUR** options (A), (B), (C) and (D). **ONE OR MORE THAN ONE** of these four option(s) is (are) correct answer(s).
- For each question, choose the option(s) corresponding to (all) the correct answer(s).
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : **+4 ONLY** if (all) the correct option(s) is(are) chosen;
Partial Marks : **+3** If all the four options are correct but **ONLY** three options are chosen;
Partial Marks : **+2** If three or more options are correct but **ONLY** two options are chosen, both of which are correct;
Partial Marks : **+1** If two or more options are correct but **ONLY** one option is chosen and it is a correct option;
Zero Marks : **0** If none of the options is chosen (i.e. the question is unanswered);
Negative Marks : **−2** In all other cases.

- For example, in a question, if (A), (B) and (D) are the ONLY three options corresponding to correct answers, then

choosing ONLY (A), (B) and (D) will get +4 marks;
choosing ONLY (A) and (B) will get +2 marks;
choosing ONLY (A) and (D) will get +2marks;
choosing ONLY (B) and (D) will get +2 marks;
choosing ONLY (A) will get +1 mark;
choosing ONLY (B) will get +1 mark;
choosing ONLY (D) will get +1 mark;
choosing no option(s) (i.e. the question is unanswered) will get 0 marks and
choosing any other option(s) will get −2 marks.

5. Among the following, the correct statement(s) for electrons in an atom is(are)
(A) Uncertainty principle rules out the existence of definite paths for electrons.
(B) The energy of an electron in 2s orbital of an atom is lower than the energy of an electron that is infinitely far away from the nucleus.
(C) According to Bohr's model, the most negative energy value for an elctron is given by n = 1, which corresponds to the most stable orbit.
(D) According to Bohr's model, the magnitude of velocity of electrons increases with increases in values of n.

Ans. **(ABC)**

Sol. (A) Uncertainty principle rules out existence of definite paths or trajectories of electron and other similar particles. So, option (A) is correct.
(B) Shell or orbit more near to nucleus has less energy than far away.
So, option (B) is also correct.
(C) $E = -13.6\dfrac{Z^2}{n^2}$ eV / atom
So, n = 1 has most negative energy.
So, option (C) is also correct.
(D) $V = V_0 \times \dfrac{Z}{n}$
When n increases velocity decreases.
So, option (D) is incorrect.

6. Reaction of iso-propylbenzene with O_2 following by the treatment with H_3O^+ forms phenol and a by-product **P**. Reaction of **P** with 3 equivalents of Cl_2 gives compound **Q**. Treatment of **Q** with $Ca(OH)_2$ produces compound **R** and calcium salt **S**.
The correct statement(s) regarding **P**, **Q**, **R** and **S** is(are)
(A) Reaction of **P** with **R** in the presence of KOH followed by acidification gives

(B) Reaction of **R** with O_2 in the presence of light gives phosgene gas
(C) **Q** reacts with aqueous NaOH to produce Cl_3CCH_2OH and $Cl_3CCOONa$
(D) S on heating gives **P**

Ans. (ABD)

Sol. Isopropyl benzene $\xrightarrow[2.\ H_3O^+]{1.\ O_2/\Delta}$ OH (phenol) + $CH_3-\underset{\underset{O}{||}}{C}-CH_3$ (P)

(P) $\xrightarrow{3\text{ eq. } Cl_2}$ $CCl_3-\underset{\underset{O}{||}}{C}-CH_3$ (Q)

(Q) $\xrightarrow{Ca(OH)_2}$ $CHCl_3$ (R) + $(CH_3CO_2)_2Ca$ (S)

(A) $CH_3-\underset{\underset{O}{||}}{C}-CH_3$ (P) + KOH + $CHCl_3$ (R) $\longrightarrow$ $CH_3-\underset{OH}{\overset{CH_3}{C}}-CCl_3$
Chloretone

(B) $2CHCl_3$ (R) $+ O_2 \xrightarrow{h\nu}$ $2COCl_2$ (Phosgene gas) + 2HCl

(C) $CH_3-\underset{\underset{O}{||}}{C}-CCl_3 \xrightarrow{\text{eq. NaOH}} CH_3-\underset{\underset{O}{||}}{C}-O + CHCl_3$

(D) $\begin{matrix} CH_3-\overset{O}{\overset{||}{C}}-O \\ CH_3-\underset{O}{\underset{||}{C}}-O \end{matrix}$ Ca $\xrightarrow{\Delta}$ $CaCO_3(s) + CH_3-\overset{O}{\overset{||}{C}}-CH_3$ (vap)

7. The option(s) in which at least three molecules follow Octet Rule is(are)

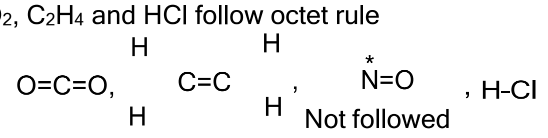
(A) CO_2, C_2H_4, NO and HCl (B) NO_2, O_3, HCl and H_2SO_4

(C) BCl_3, NO, NO_2 and H_2SO_4 (D) CO_2, BCl_3, O_3 and C_2H_4

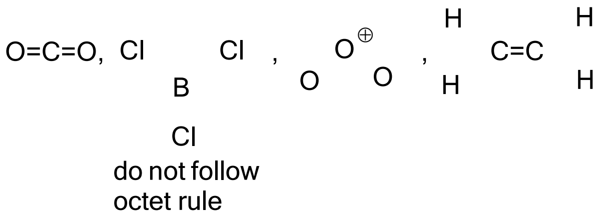
The option(s) in which at least three molecules follow Octet Rule is(are)

Ans. **(AD)**

Sol. (A) CO_2, C_2H_4 and HCl follow octet rule



(D) CO_2, O_3 and C_2H_4 follow octet rule



SECTION-3 : 24 Marks

- This section contains **SIX (06)** questions.
- The answer to each question is a **NON-NEGATIVE INTEGER**.
- For each question, enter the correct integer corresponding to the answer using the mouse and the on--screen virtual numeric keypad in the place designated to enter the answer.
- Answer to each question will be evaluated according to the following marking scheme:

Full Marks : **+4 ONLY** the correct integer value is entered;

Zero Marks : **0** In all other cases.

8. Consider the following volume−temperature (V−T) diagram for the expansion of 5 moles of an ideal monoatomic gas.

Considering only P-V work is involved, the total change in enthalpy (in Joule) for the transformation of state in the sequence X→Y→Z is_______.

[Use the given data: Molar heat capacity of the gas for the given temperature range, $C_{V,m}$ = 12 J K^{-1} mol^{-1} and gas constant, R = 8.3 J K^{-1} mol^{-1}]

Ans. (8120)

Sol. X → Y is an isothermal process and for ideal bas

$\Delta H = 0$

Y → Z is an isochoric process

$\Delta U = nC_{V,m}(T_2 - T_1)$

$= 5 \times 12\,(415 - 335)$

= 4800 J

$\Delta H = \Delta U + \Delta(PV)$

$= \Delta U + nR\Delta T$

$= 4800 + 5 \times 8.3 \times (415 - 335) = 8120$ J

9. Consider the following reaction,

$$2H_2\,(g) + 2NO\,(g) \rightarrow N_2\,(g) + 2H_2O\,(g)$$

which follows the mechanism given below:

$N_2O_2\,(g) + H_2\,(g) \xrightarrow{k_2} N_2O\,(g) + H_2O\,(g)$ (slow reaction)

$N_2O\,(g) + H_2\,(g) \xrightarrow{k_3} N_2\,(g) + H_2O\,(g)$ (fast reaction)

The order of the reaction is_______.

Ans. **(3)**

Sol. Rate of reaction (according to slowest step)

$\Rightarrow r = k_2(N_2O_2)\,[H_2]$ .... (1)

Now for intermediate $[N_2O_2]$

$$\frac{k_1}{k_{-1}} = \frac{[N_2O_2]}{[NO]^2}$$

$\Rightarrow [N_2O_2] = \dfrac{k_1}{k_{-1}}[NO]^2$ ....(2)

from equation (1) and (2)

$$r = \frac{k_2k_1}{k_{-1}}[NO]^2[H_2]$$

overall order of reaction = 2 + 1 = 3

10. Complete reaction of acetaldehyde with excess formaldehyde, upon heating with conc. NaOH solution, gives **P** and **Q**. Compound **P** does not give Tollens' test, whereas **Q** on acidification gives positive Tollens' test. Treatment of **P** with excess cyclohexanone in the presence of catalytic amount of p-toluenesulfonic acid (PTSA) gives product **R**.

Sum of the number of methylene groups ($-CH_2-$) and oxygen atoms in **R** is_______.

Ans. **(18)**

Sol.

H3-CH=O + HCHO aOH
xcess

O — H
O — H
+ COONa
Q)
entaerythritol
(P)

⊕ , Acidification

PTSA)H⊕

O O
O O
(R)

COOH
tollens
reagent

ilver mirror

Number of 'O' atoms in R is 4
Number of $-CH_2-$ in R is 14
sum = 18

11. Among $V(CO)_6$, $Cr(CO)_5$, $Cu(CO)_3$, $Mn(CO)_5$, $Fe(CO)_5$, $[Co(CO)_3]^{3-}$, $[Cr(CO)_4]^{4-}$, and $Ir(CO)_3$, the total number of species isoelectronic with $Ni(CO)_4$ is_______.

[Given, atomic number: V = 23, Cr = 24, Mn = 25, Fe = 26, Co = 27, Ni = 28, Cu = 29, Ir = 77]

Ans. **(1)**

Sol. Total number of electron in $Ni(CO)_4$ = 84

species		**Total**
$V(CO)_6$	–	107
$Cr(CO)_5$	–	94
$Cu(CO)_3$	–	71
$Mn(CO)_5$	–	95
$Fe(CO)_5$	–	96
$[Co(CO)_3]^{3-}$	–	72
$[Cr(CO)_4]^{4-}$	–	84
$Ir(CO)_3$	–	119

12. In the following reaction sequence, the major product **P** is formed.

Glycerol reacts completely with excess **P** in the presence of an acid catalyst to form **Q**. Reaction of **Q** with excess NaOH followed by the treatment with $CaCl_2$ yields Ca-soap **R**, quantitatively.
Starting with one mole of **Q**, the amount of **R** produced in gram is_______.
[Given, atomic weight: H = 1, C = 12, N = 14, O = 16, Na = 23, Cl = 35, Ca = 40]

Ans. **(909)**

Sol.

H-C ___C-$(CH_2)_{15}$ -CO_2Et 1. Hg^{2+}, $H_3O^{\oplus}$ 2. Zn-Hg/HCl 3. $H_3O^{\oplus}$, Δ $CH_3(-CH_2-)_{16}$-COOH
P

CH_2OH
$CHOH$, $H^{\oplus}$
CH_2OH

CH_2-O-$CO(CH_2)_{16}$ CH_3CH-O-
$CO(CH_2)_{16}$ CH_3
CH_2O-$CO(CH_2)_{16}$ CH_3
(Q) Triglyceride

NaOH (Excess)
(Saponification)

CH_2OH
CH_2OH
CH_2OH
+
$3CH_3$-$(CH_2$-$)_{16}$COONa

$CaCl_2$

$\frac{3}{2}$ CH_3-$(CH_2$-$)_{16}$ $COO)_2Ca$

Molar mass = 606
Weight of Ca-Soap = 606 × 1.5 = 909 gm

13. Among the following complexes, the total number of diamagnetic species is_______.
$[Mn(NH_3)_6]^{3+}$, $[MnCl_6]^{3-}$, $[FeF_6]^{3-}$, $[CoF_6]^{3-}$, $[Fe(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$
[Given, atomic number: Mn = 25, Fe = 26, Co = 27 ; en = $H_2NCH_2CH_2NH_2$]

Ans. **(1)**

Sol. $[Co(en)_3]^{3+}$: Diamagnetic
Only 1 complex is diamagnetic

SECTION 4 : 12 Marks

- This section contains **FOUR (04)** Matching List Sets.
- Each set has **ONE** Multiple Choice Question.
- Each set has **TWO** lists: **List-I** and **List-II**.
- **List-I** has **Four** entries (P), (Q), (R) and (S) and **List-II** has **Five** entries (1), (2), (3), (4) and (5).
- **FOUR** options are given in each Multiple Choice Question based on **List-I** and **List-II** and **ONLY ONE** of these four options satisfies the condition asked in the Multiple Choice Question.
- Answer to each question will be evaluated according to the following marking scheme:
  Full Marks : **+3 ONLY** if the option corresponding to the correct combination is chosen;
  Zero Marks ~~: **0** If none of the options is chosen (i.e. the question is unanswered);~~
  Negative Marks : **–1** In all other cases.

14. In a conductometric titration, small volume of titrant of higher concentration is added stepwise to a larger volume of titrate of much lower concentration, and the conductance is measured after each addition.
The limiting ionic conductivity (Λ_0) values (in mS m^2 mol^{-1}) for different ions in aqueous solutions are given below:

Ions	Ag^+	K^+	Na^+	H^+	NO_3^-	Cl^-	SO_4^{2-}	OH^-	CH_3COO^-
Λ_0	6.2	7.4	5.0	35.0	7.2	7.6	16.0	19.9	4.1

For different combinations of titrates and titrants given in List-I, the graphs of 'conductance' versus 'volume of titrant' are given in List-II. Match each entry in List-I with the appropriate entry in List-II and choose the correct option.

List-I		**List-II**
(P)	Titrate: KCl ; Titrant: $AgNO_3$	(1)
(Q)	Titrate: $AgNO_3$; Titrant: KCl	(2)
(R)	Titrate: NaOH ; Titrant: HCl	(3)
(S)	Titrate: NaOH ; Titrant: CH_3COOH	(4)
		(5)

(A) P-4, Q-3, R-2, S-5 (B) P-2, Q-4, R-3, S-1 (C) P-3, Q-4, R-2, S-5 (D) P-4, Q-3, R-2, S-1

Ans. **(C)**

Sol. (P) $KCl + AgNO_3 \rightarrow AgCl\downarrow + KNO_3$

Cl^- is replaced by NO_3^-

Conductance will first decrease and then after equivalence point, it will increase

$P \rightarrow 3$ Given the limiting ionic conductivity Λ_0 values in mS m^2 mol^{-1} for Cl^- is greater than NO_3^-

(Q) $AgNO_3 + KCl \rightarrow AgCl + KNO_3$

Ag^+ is replaced by K^+

Conductance will first increase slightly and then will increase further

(R) $NaOH + HCl \rightarrow NaCl + H_2O$

OH^- is replaced by Cl^-

(S) $NaOH + CH_3COOH \rightarrow CH_3CCOONa + H_2O$, OH^- is replaced by CH_3COO^- conductance will first decrease and them become almost constant due to buffer formation.

15. Based on VSEPR model, match the xenon compounds given in **List-I** with the corresponding geometries and the number of lone pairs on xenon given in **List-II** and choose the correct option.

List-I		**List-II**
(P)	XeF_2	(1) Trigonal bipyramidal and two lone pair of electrons
(Q)	XeF_4	(2) Tetrahedral and one lone pair of electrons
(R)	XeO_3	(3) Octahedral and two lone pair of electrons
(S)	XeO_3F_2	(4) Trigonal bipyramidal and no lone pair of electrons
		(5) Trigonal bipyramidal and three lone pair of electrons

(A) P-5, Q-2, R-3, S-1
(B) P-5, Q-3, R-2, S-4
(C) P-4, Q-3, R-2, S-1
(D) P-4, Q-2, R-5, S-3

Ans. **(B)**

Sol. Theory based.

16. **List-I** contains various reaction sequences and **List-II** contains the possible products. Match each entry in **List-I** with the appropriate entry in **List-II** and choose the correct option.

List-I **List-II**

(P) $\xrightarrow{\text{(i) } O_3\text{, Zn; (ii) aq. NaOH, } \Delta\text{; (iii) ethylene glycol, PTSA}}$ (1)

(Q) $\xrightarrow{\text{(i) } O_3\text{, Zn; (ii) aq. NaOH, } \Delta}$ (i) ethylene glycol, PTSA (ii) (a) BH_3, (b) H_2O_2, NaOH (v) H_3O^+ (vi) $NaBH_4$ (2)

(R) $\xrightarrow{\text{(i) ethylyene glycol, PTSA}}$ (ii) (a) $Hg(OAc)_2, H_2O$, (b) $NaBH_4$ (iii) H_3O^+ (iv) $NaBH_4$ (3)

(S) $\xrightarrow[\text{(ii) (a) } BH_3\text{, (b) } H_2O_2\text{, NaOH} \quad \text{(iii) } H_3O^+ \quad \text{(iv) } NaBH_4]{\text{(i) ethylyene glycol, PTSA}}$ (4)

(5)

(A) P-3, Q-5, R-4, S-1 (B) P-3, Q-2, R-4, S-1

(C) P-3, Q-5, R-1, S-4 (D) P-5, Q-2, R-4, S-1

Ans. **(A)**

Sol.

(P) O_3/Zn CH=O CH=O aq. NaOH CH=O

OH , $H^{\oplus}$ OH

CH=O OH $H_3O^{\oplus}$ O O OH BH_3 H_2O_2., OH^- O O

$NaBH_4$

OH

OH

(3)

(Q) CH_3 1. O_3/Zn 2. NaOH O OH ,$H^{\oplus}$ OH O O (5)

BH_3, H_2O_2, OH^-

OH OH $NaBH_4$ O OH $H_3O^{\oplus}$ O O OH

(R) O CH3 $\xrightarrow[\text{2. } Hg(OAc)_2,\ H_2O \quad NaBH_4]{\text{1. OH, OH, } H^{\oplus}}$ O O CH3 OH (5)

$H_3O^{\oplus}$

OH CH3 OH $\xleftarrow{NaBH_4}$ O CH3 OH

(4)

(S) O CH3 $\xrightarrow[\text{2. } BH_3, H_2O_2, OH^- \quad \text{3. } H_3O^{\oplus}]{\text{1. OH, OH, } H^{\oplus}}$ O CH3 OH

$NaBH_4$

OH CH3 OH (1)

17. **List-I** contains various reaction sequences and **List-II** contains different phenolic compounds. Match each entry in **List-I** with the appropriate entry in **List-II** and choose the correct option.

List-I	**List-II**
(P) SO_3H $\xrightarrow[\text{(ii) Conc. } HNO_3]{\text{(i) molten NaOH, } H_3O^+}$	(1) OH, O_2N, NO_2
(Q) NO_2 $\xrightarrow[\text{(iv) } H_2O \quad \text{(v) Conc. } HNO_3/\text{Conc.} H_2SO_4]{\text{(i) Conc. } HNO_3/\text{Conc.} H_2SO_4 \quad \text{(ii) Sn/HCl} \quad \text{(iii) } NaNO_2/HCl, 0-5^\circ C}$	(2) OH, NO_2, NO_2
(R) OH, OH $\xrightarrow[\text{(iii) } H_3O^+, \Delta]{\text{(i) Conc. } H_2SO_4 \quad \text{(ii) Conc. } HNO_3}$	(3) OH, O_2N, NO_2, NO_2

(S) $\xrightarrow[\text{(iv) } Br_2, NaOH \text{ (v) } NaNO_2 / HCl, 0-5^{\circ}C \text{ (vi) } H_2O]{\text{(i) (a) } KMnO_4/KOH, \Delta; \text{(b) } H_3O^+ \text{ (ii) Conc. } HNO_3/\text{Conc. } H_2SO_4, \Delta \text{ (iii) (a) } SOCl_2, \text{(b) } NH_3}$

(4) OH, NO_2, OH

OH, O_2N, NO_2, OH, NO_2

(5)

(A) P-2, Q-3, R-4, S-5 (B) P-2, Q-3, R-5, S-1

(C) P-3, Q-5, R-4, S-1 (D) P-3, Q-2, R-5, S-4

Ans. **(C)**

Sol. (P) SO_3H $\xrightarrow[H_3O^{\oplus}]{NaOH/\Delta}$ OH $\xrightarrow[HNO_3]{Conc.}$ OH, NO_2, NO_2, NO_2 (3)

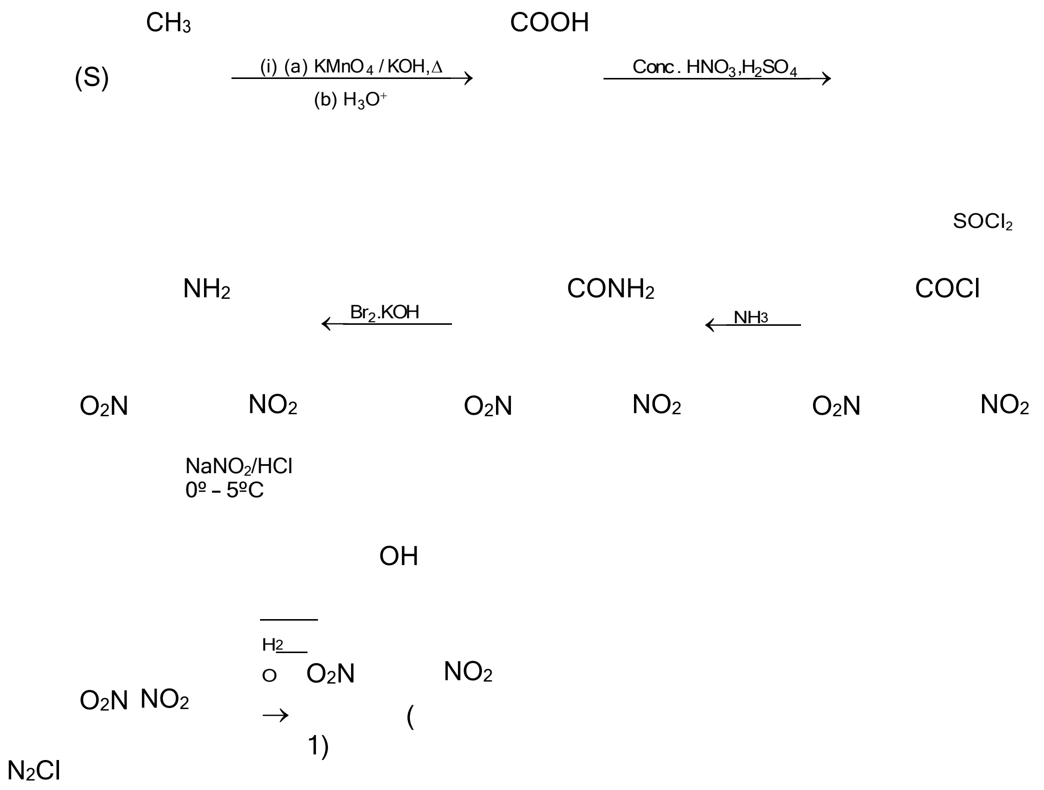
(Q) NO_2 $\xrightarrow{Conc.HNO_3/H_2SO_4}$ NO_2, NO_2 $\xrightarrow{Sn/HCl}$ NH_2, NH_2

$NaNO_2/HCl$, $0^{\circ}-5^{\circ}C$

N_2Cl, N_2Cl $\xrightarrow{H_2O}$ OH, OH $\xrightarrow[Conc.H_2SO_4]{Conc.HNO_3}$ OH, NO_2, NO_2, OH, NO_2 (5)

(R) OH, OH $\xrightarrow[\text{(iii)} H_3O^{\oplus}/\Delta]{\text{(i) Conc.} H_2SO_4 \text{ (ii) Conc. } HNO_3}$ OH, NO_2, OH (4)

(S)


CH3
(i) (a) KMnO4 / KOH,Δ
(b) H3O+
COOH
Conc. HNO3,H2SO4
SOCl2
NH2
Br2.KOH
CONH2
NH3
COCl
O2N
NO2
O2N
NO2
O2N
NO2
NaNO2/HCl
0º – 5ºC
OH
H2
O
O2N
NO2
O2N NO2
→
(
1)
N2Cl