JEE(ADVANCED)–2024 (EXAMINATION)

(Held On Sunday 26th MAY, 2024)

CHEMISTRY | **TEST PAPER WITH ANSWER AND SOLUTION**

PAPER-1

SECTION-1 : (Maximum Marks : 12)

- 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.

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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) $2\sqrt{2} : \sqrt{3}$ (B) $2\sqrt{2} : 1$ (C) 1 : 2 (D) 2 : 1

Ans. (D)

Sol. For Ideal Gas

$PV = nRT$

$\therefore$ $n \propto P$ at constant T & V.

$\because$ $\text{mole} = \dfrac{\text{Mass}}{\text{Molar mass}}$

For gas X : $\dfrac{10}{M_X} \propto 2$ atm ..... (1)

For gas X & Y : $\dfrac{10}{M_X} + \dfrac{80}{M_Y} \propto 6$ atm ..... (2)

From (2) – (1)

$\dfrac{80}{M_y} \propto 4$ ..... (3)

On dividing (1) by (3)

$\dfrac{M_Y}{8M_X} = \dfrac{1}{2}$

$\therefore$ $\dfrac{M_Y}{M_X} = 4$ ..... (4)

$\because$ $V_{rms} = \sqrt{\dfrac{3RT}{M}} \Rightarrow V_{rms} \propto \dfrac{1}{\sqrt{M}}$

$\therefore$ $\dfrac{(V_{rms})_X}{(V_{rms})_Y} = \sqrt{\dfrac{M_Y}{M_X}} = \sqrt{\dfrac{4}{1}} = \dfrac{2}{1}$

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

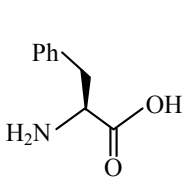
(D) H_3O^+, NO_3^- and N_2O

Ans. (A)

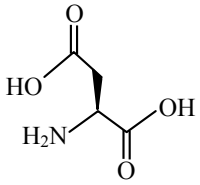
Sol. $3HNO_2(aq) \rightleftharpoons H_3O^+ + NO_3^- + 2NO$

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

Structures of phenylalanine and aspartic acid are given below.

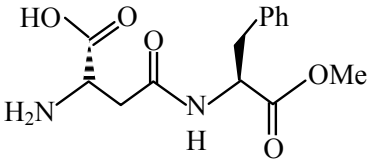


Phenylalanine

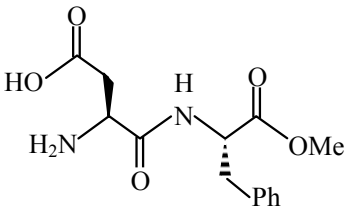


Aspartic acid

(A)



(B)



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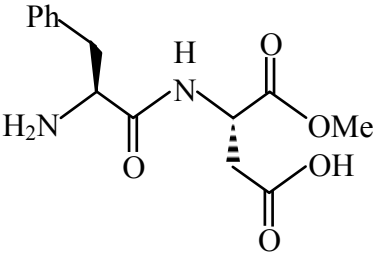
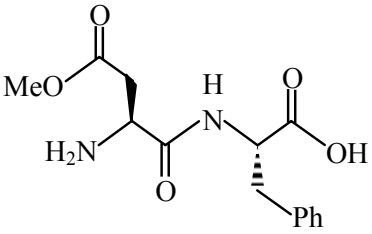
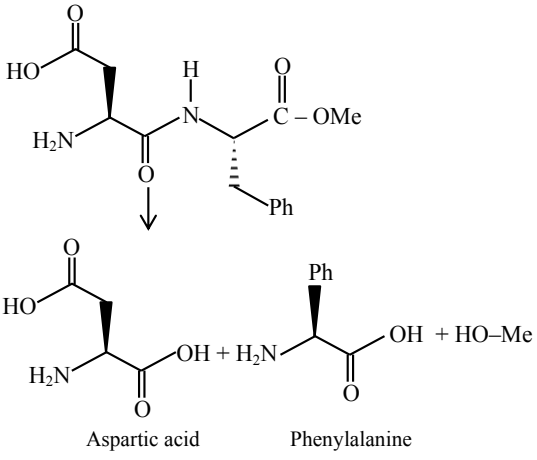


(D)



Ans. (B)

Sol. Aspartame structure is a dipeptide consisting aspartic acid and methyl ester of phenylalanine



Aspartic acid Phenylalanine

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 : $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$

Ans. (C)

Sol. **Set-I :** $[Co(NH_3)_3(NO_2)_3]$ shows two geometrical isomers :- facial and meridional
$[Co(en)_2Cl_2]$ shows two geometrical isomers :- cis and trans
Set-II : $[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$ are ionization isomers of each other.

SECTION-2 : (Maximum Marks : 12)

- 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 <u>according to the following marking scheme</u>:

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 +2 marks;
choosing ONLY (B) and (D) will get +2 marks;
choosing ONLY (A) will get +1 marks;
choosing ONLY (B) will get +1 marks;
choosing ONLY (D) will get +1 marks;
choosing no option (i.e. the question is unanswered) will get 0 marks; and
choosing any other combination of options 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 2*s* 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 electron 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 increase in values of n.

Ans. (A,B,C)

Sol. (A) Uncertainity principle talks about probability of finding electrons in different regions around the nucleus rather than definite paths.

(B) With increase in distance of electron from the nucleus, its energy increases.

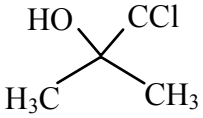
(C) Energy of electron $E_n = -13.6 \times \frac{Z^2}{n^2}$ eV/atom.

(D) Velocity of electron $V_n = 2.19 \times 10^6 \times \frac{Z}{n}$ m/sec.

6. Reaction of *iso*-propylbenzene with O_2 followed 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



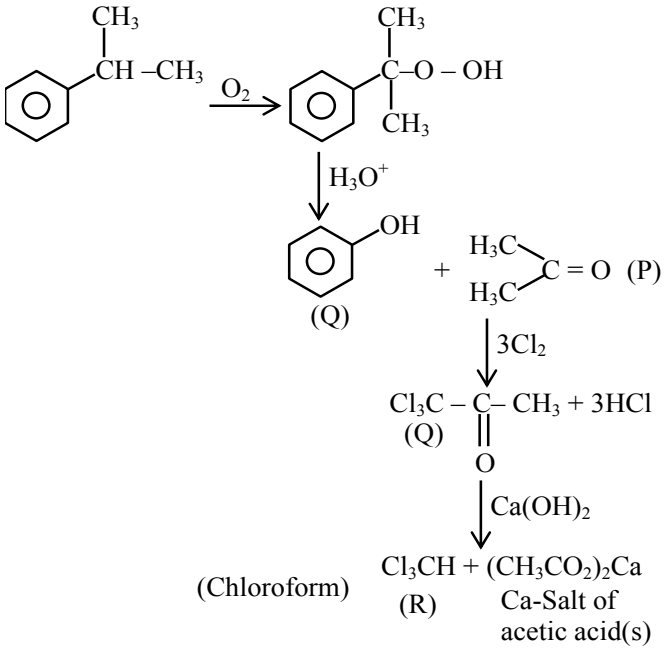
(B) Reaction of **R** with O_2 in the presence of light gives phosgene gas

(C) **Q** reacts with aqueous NaOH to produce Cl_3CCH_2OH and $Cl_3CCOONa$

(D) **S** on heating gives **P**

Ans. (A,B,D)

Sol.



(A) $CHCl_3$ + $(H_3C)_2C=O$ → (KOH) → $(H_3C)_2C(OH)CCl_3$ (Chloritone)

(B) $\underset{(R)}{CHCl_3} \xrightarrow{O_2} \underset{\text{Phosgene gas}}{COCl_2} + HCl$

(C) Q does not undergo Cannizaro reaction

(D) $(CH_3-C(=O)-O)_2Ca \xrightarrow{\Delta} \xrightarrow{CaCO_3} CH_3-C(=O)-CH_3 + CaCO_3$

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

Ans. **(A,D)**

Sol. NO, NO_2 , BCl_3 and H_2SO_4 do not follow octet rule.

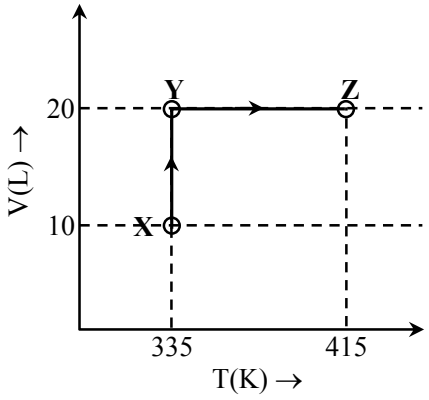
SECTION-3 : (Maximum Marks : 24)

- 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** If the correct integer 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** $\rightarrow$ **Y** $\rightarrow$ **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. For ideal gas

$\Delta H = nC_P\Delta T$

$\because$ $C_P = C_V + R = 12 + 8.3 = 20.3$ J/K-mole

$\therefore$ $\Delta H = 5 \times 20.3 \times (415 - 335)$

$\boxed{\Delta H = 8120 \text{ Joule}}$

9. Consider the following reaction,

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

which follows the mechanism given below:

$$2NO(g) \underset{k_{-1}}{\overset{k_1}{\rightleftharpoons}} N_2O_2(g) \qquad \text{(fast equilibrium)}$$

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

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

The order of the reaction is_____.

Ans. (3)

Sol. Rate law = $k_2\ [N_2O_2]\ [H_2]$ [$\because$ slowest step of reaction is RDS]

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

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

$\therefore$ $\text{Rate} = k_2 \times \dfrac{k_1}{k_{-1}}\ [NO]^2\ [H_2]$

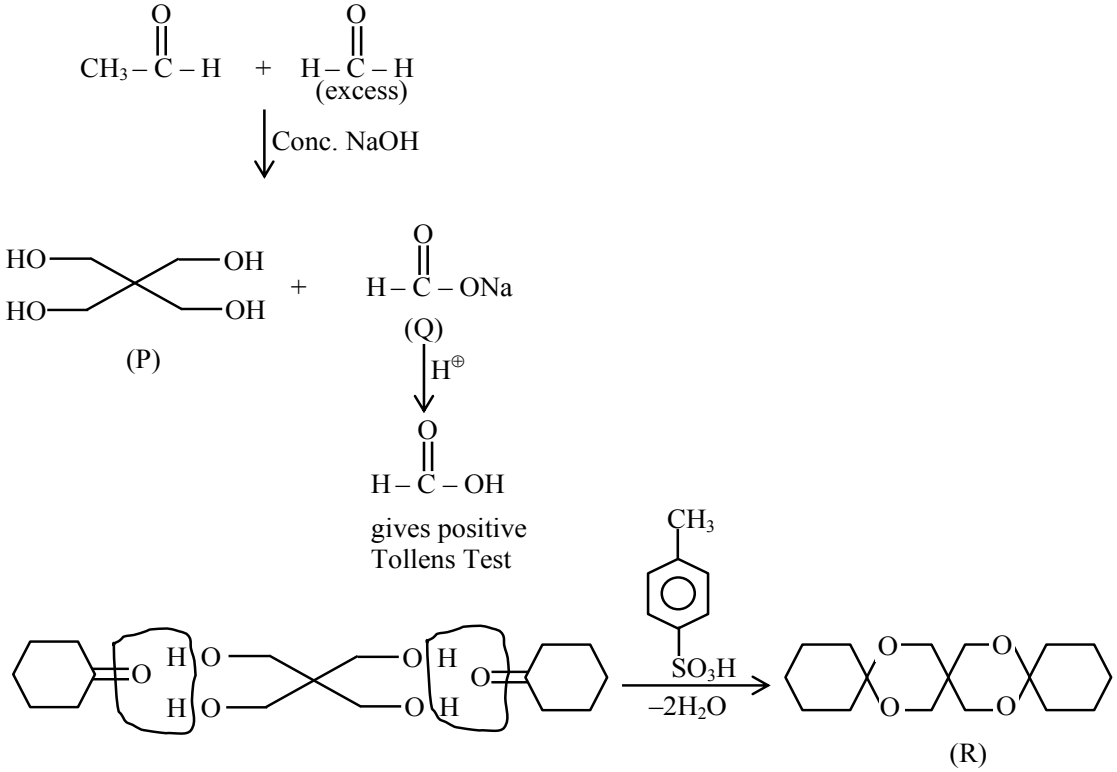
$\therefore$ Order of reaction is (3)

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.



Total CH_2 in R = 14

and oxygen in R= 4

So 14 + 4 = 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. (3)

Sol. In case of complexes, isoelectronic species should be those having same effective atomic number (EAN)

$Ni(CO)_4 \Rightarrow 28 + 4 \times 2 = 36$

(i) $V(CO)_6 \Rightarrow 23 + 2 \times 6 = 35$

(ii) $Cr(CO)_5 \Rightarrow 24 + 2 \times 5 = 34$

(iii) $Cu(CO)_3 \Rightarrow 29 + 2 \times 3 = 35$

(iv) $Mn(CO)_5 \Rightarrow 25 + 2 \times 5 = 35$

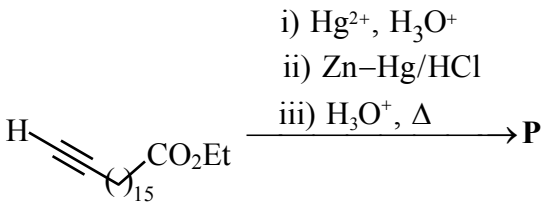
(v) $Fe(CO)_5 \Rightarrow 26 + 2 \times 5 = 36$

(vi) $[Co(CO)_3]^{3-} \Rightarrow 27 + 3 + 2 \times 3 = 36$

(vii) $[Cr(CO)_4]^{4-} \Rightarrow 24 + 4 + 2 \times 4 = 36$

(viii) $[Ir(CO)_3] \Rightarrow 77 + 2 \times 3 = 83$

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.

$$H-C\equiv C-(CH_2)_{15}-CO_2Et \xrightarrow{Hg^{2+}/H_3O^+} H_3C-\overset{O}{\overset{\|}{C}}-(CH_2)_{15}-CO_2Et \xrightarrow{Zn(Hg)+\text{Conc. HCl}} H_3C-CH_2-(CH_2)_{16}-CO_2Et \xrightarrow{H_3O^+} H_3C-(CH_2)_{16}-CO_2H \xrightarrow{\text{Glycerol}/H^+}$$

Glyceryl stearate (Q) (1 mole)

$$\xrightarrow{\text{NaOH (excess)}} \underset{CH_2OH}{\overset{CH_2OH}{\overset{|}{CH_2OH}}} + 3C_{17}H_{35}CO_2Na \text{ (3 mole)} \xrightarrow{CaCl_2} (C_{17}H_{35}CO_2)_2Ca \text{ (Soap)}$$

3/2 mole

$$\frac{3}{2}\text{ mole soap.} = \frac{3}{2}\times 606\text{ gm} = 909\text{ gm}$$

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. $Mn^{3+} \Rightarrow [Ar]3d^4$

d^4 configuration in t_{2g} and e_g orbitals will always have unpaired electrons irrespective of SFL and WFL.

$Fe^{3+} \Rightarrow [Ar]3d^5$

d^5 configuration will also have unpaired electron irrespective of SFL and WFL.

$Co^{3+} \Rightarrow [Ar]3d^6$

$d^6 \Rightarrow$ it can be both paramagnetic or diamagnetic based on field of ligands.

In case of $F^- \Rightarrow$ weak field ligand, configuration will be $t_{2g}^4e_g^2$ hence it is paramagnetic but in case of en $\Rightarrow$ strong filed ligand, configuration will be $t_{2g}^6e_g^0$ hence it will be diamagnetic.

SECTION-4 : (Maximum Marks : 12)

- 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 <u>according to the following marking scheme</u>:

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.

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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

(P) Titrate : KCl
Titrant : $AgNO_3$

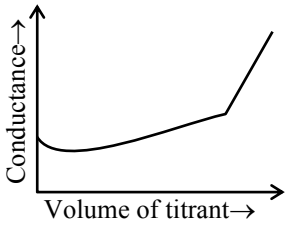
(Q) Titrate : $AgNO_3$
Titrant : KCl

(R) Titrate : NaOH
Titrant : HCl

(S) Titrate : NaOH
Titrant : CH_3COOH

List-II

(1)



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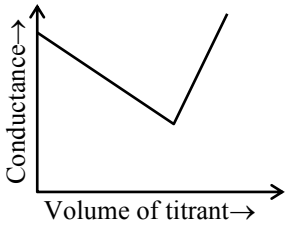

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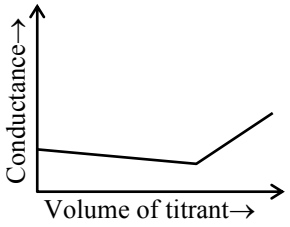

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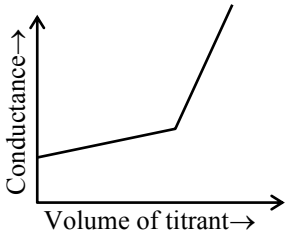

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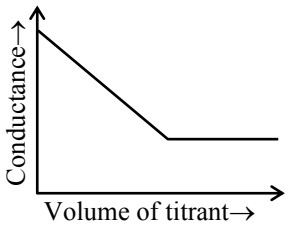


(A) P → 4, Q → 3, R → 2, S → 5

(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. Option (P) :

On adding $AgNO_3$ solution to KCl solution precipitation of AgCl will occur due to which Cl^- already present will be replaced by NO_3^- ions. So conductance of solution will decrease till equivalence point. After complete precipitation of AgCl, further added $AgNO_3$ will increase the number of ions in resulting solution so conductance will increase.

Option (Q) :

On adding KCl solution to $AgNO_3$ solution precipitation of AgCl will occur due to which already present Ag^+ ions will be replaced by K^+ ions in solution. So conductance of solution will increase. After complete precipitation of AgCl further added KCl will increase the number of ions in resulting solution so conductance will increase further.

Option (R) :

On adding HCl solution to NaOH solution, OH^- will be replaced by Cl^- ions so conductance of solution decreases. After complete neutralisation further added HCl will increase number of ions in the solution. So conductance will increase futher.

Option (S) :

On adding CH_3COOH solution to NaOH solution OH^- will be replaced by CH_3COO^- ions, so conductance of solution decreases. After complete neutralisation further added CH_3COOH will remain undissociated because it is a weak acid and there is also common ion effect on acetate ions. So number of ions in solution will remain almost constant therefore conductance of solution will remain constant.

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 $\rightarrow$ 5, Q $\rightarrow$ 2, R $\rightarrow$ 3, S $\rightarrow$ 1

(B) P $\rightarrow$ 5, Q $\rightarrow$ 3, R $\rightarrow$ 2, S $\rightarrow$ 4

(C) P $\rightarrow$ 4, Q $\rightarrow$ 3, R $\rightarrow$ 2, S $\rightarrow$ 1

(D) P $\rightarrow$ 4, Q $\rightarrow$ 2, R $\rightarrow$ 5, S $\rightarrow$ 3

Ans. (B)

Sol. $XeF_2 \Rightarrow$ 2 sigma bonds and 3 lone pairs on Xe, number of hybrid orbitals = 5, sp^3d hybridisation , geometry will be trigonal bipyramidal.

P–5

$XeF_4 \Rightarrow$ 4 sigma bonds and 2 lone pairs on Xe, number of hybrid orbitals = 6, sp^3d^2 hybridisation , geometry will be octahedral.

Q–3

$XeO_3 \Rightarrow$ 3 sigma bonds and 1 lone pairs on Xe, number of hybrid orbitals = 4, sp^3 hybridisation , geometry will be tetrahedral.

R–2

$XeO_3F_2 \Rightarrow$ 5 sigma bonds and 0 lone pairs on Xe, number of hybrid orbitals = 5, sp^3d hybridisation , geometry will be trigonal bipyramidal.

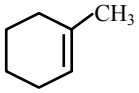
S–4

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.

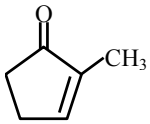
List-I

(P) 

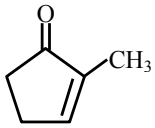
i) O_3, Zn
ii) aq. NaOH, Δ
iii) ethylene glycol, PTSA
iv) a) BH_3, b) H_2O_2, NaOH
v) H_3O^+
vi) $NaBH_4$

(Q) 

i) O_3, Zn
ii) aq. NaOH, Δ
iii) ethylene glycol, PTSA
iv) a) BH_3, b) H_2O_2, NaOH
v) H_3O^+
vi) $NaBH_4$

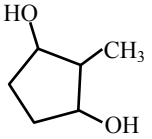
(R) 

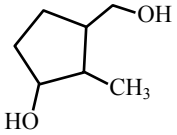
i) ethylene glycol, PTSA
ii) a) $Hg(OAc)_2$, H_2O, b) $NaBH_4$
iii) H_3O^+
iv) $NaBH_4$

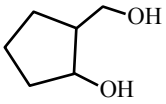
(S) 

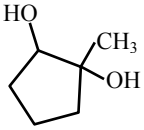
i) ethylene glycol, PTSA
ii) a) BH_3, b) H_2O_2, NaOH
iii) H_3O^+
iv) $NaBH_4$

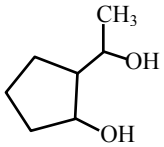
List-II

(1) 

(2) 

(3) 

(4) 

(5) 

(A) P → 3, Q → 5, R → 4, S → 1

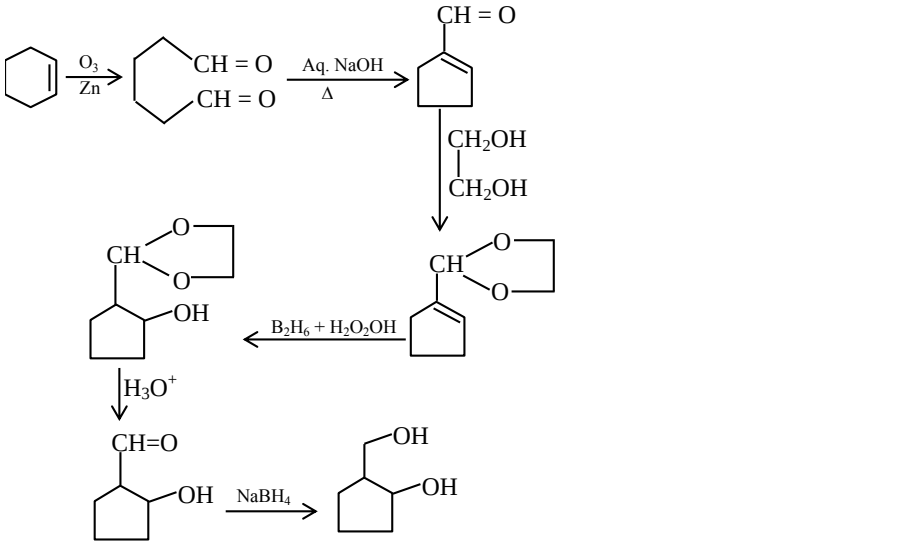
(B) P → 3, Q → 2, R → 4, S → 1

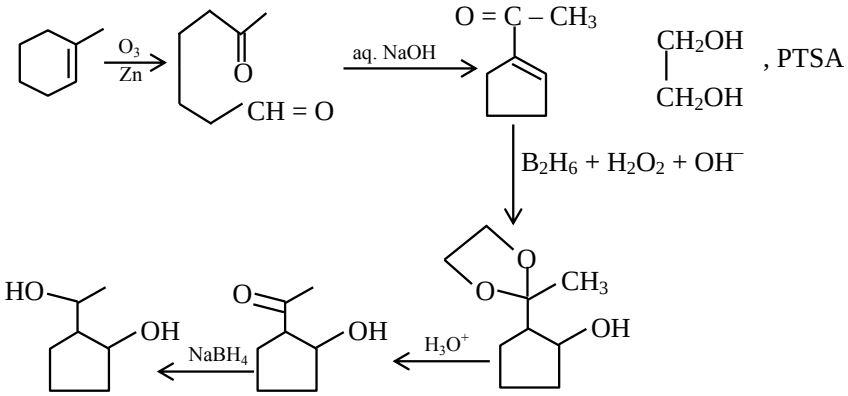
(C) P → 3, Q → 5, R → 1, S → 4

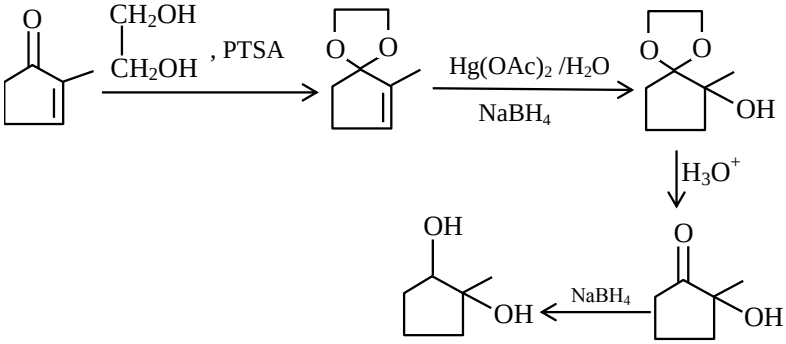
(D) P → 5, Q → 2, R → 4, S → 1

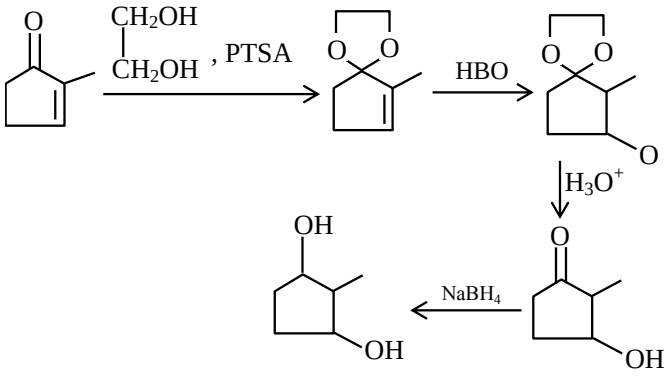
Ans. (A)

Sol.


O3
Zn
CH = O
CH = O
Aq. NaOH
Δ
CH = O
CH2OH
CH2OH
CH
O
O
OH
B2H6 + H2O2OH
H3O+
CH=O
OH
NaBH4
OH
OH

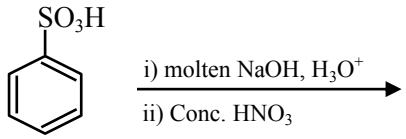

O3
Zn
O
CH = O
aq. NaOH
O = C – CH3
CH2OH
CH2OH
, PTSA
B2H6 + H2O2 + OH–
O
O
CH3
OH
H3O+
O
OH
NaBH4
HO
OH

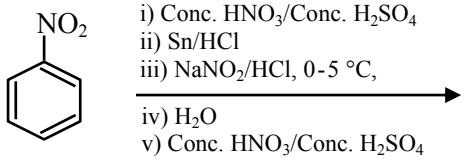

O
CH2OH
CH2OH
, PTSA
O
O
Hg(OAc)2 /H2O
NaBH4
O
O
OH
H3O+
O
OH
NaBH4
OH
OH

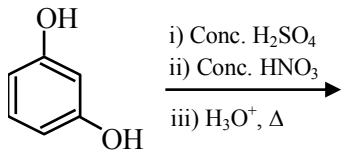

O
CH2OH
CH2OH
, PTSA
O
O
HBO
O
O
O
H3O+
O
OH
NaBH4
OH
OH

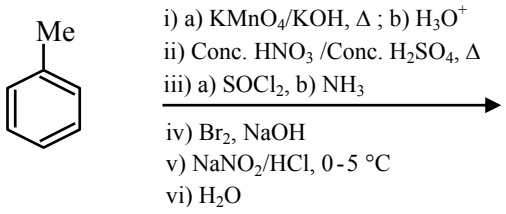
17. **List-I** contains various reaction sequences and **List-II** contains different phenolic compounds. Match each entry in **List-I** with the appropriate entry in **List-II** and choose the correct option.

List-I

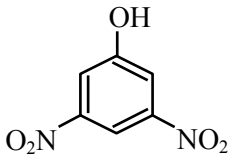
(P) 

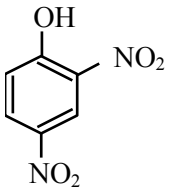
(Q) 

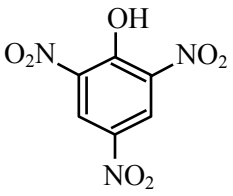
(R) 

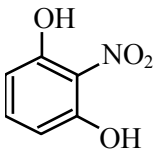
(S) 

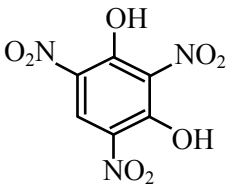
List-II

(1) 

(2) 

(3) 

(4) 

(5) 

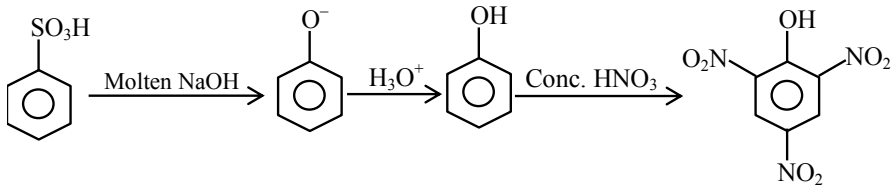
(A) P-2, Q-3, R-4, S-5

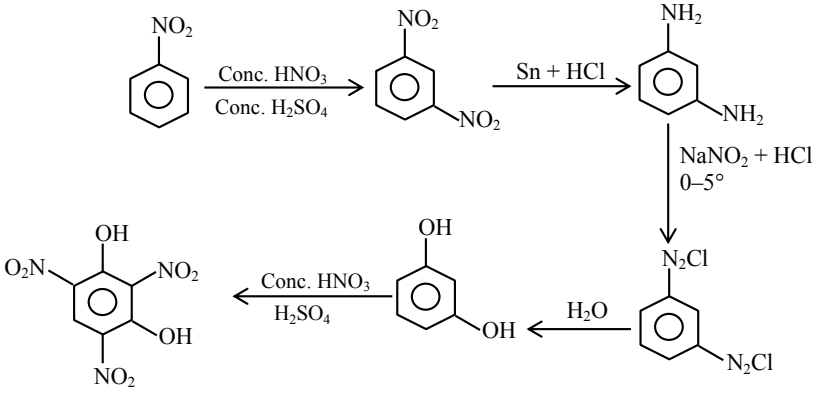
(B) P-2, Q-3, R-5, S-1

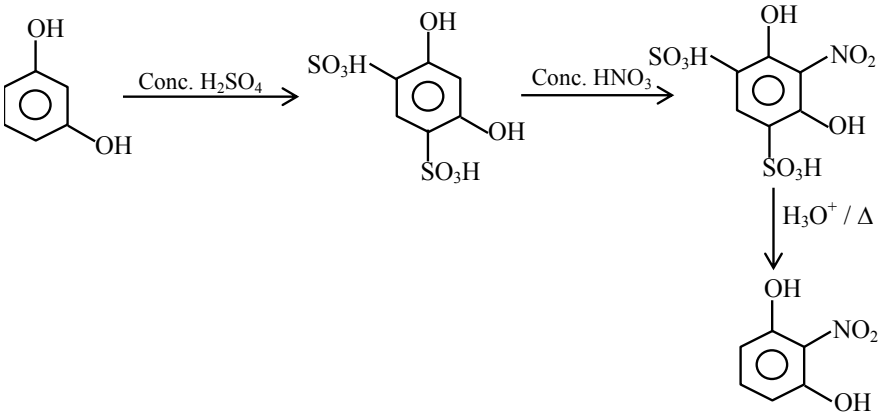
(C) P-3, Q-5, R-4, S-1

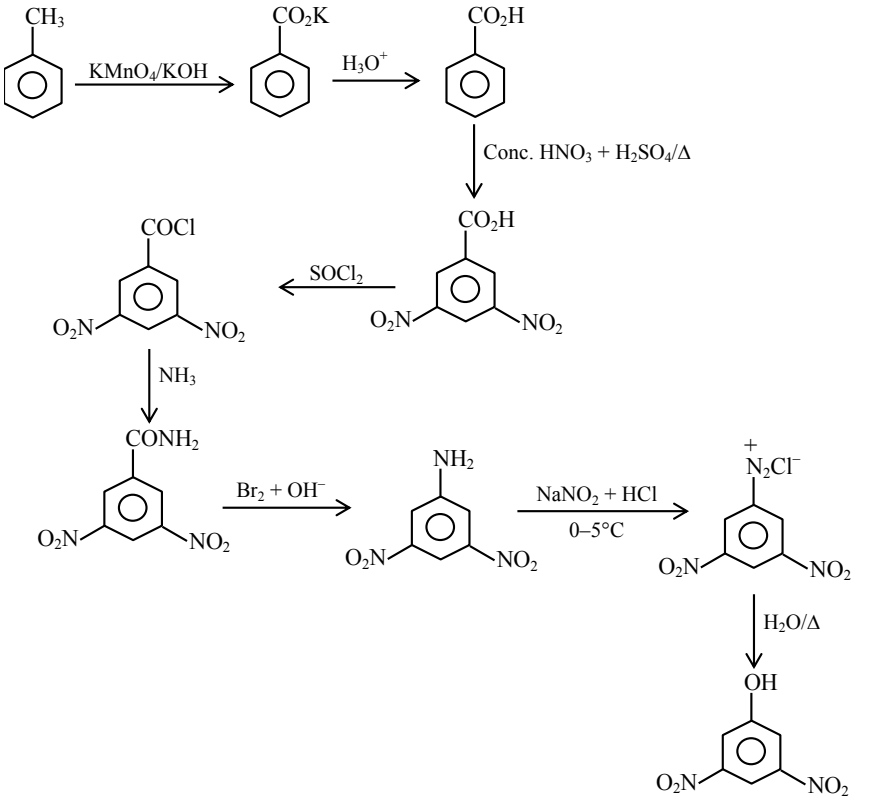
(D) P-3, Q-2, R-5, S-4

Ans. **(C)**

Sol. 


NO2
Conc. HNO3
Conc. H2SO4
NO2
NO2
Sn + HCl
NH2
NH2
NaNO2 + HCl
0–5°
N2Cl
N2Cl
H2O
OH
OH
Conc. HNO3
H2SO4
OH
O2N
NO2
OH
NO2


OH
OH
Conc. H2SO4
OH
SO3H
SO3H
Conc. HNO3
OH
SO3H
NO2
OH
SO3H
H3O+ / Δ
OH
NO2
OH


CH3
KMnO4/KOH
CO2K
H3O+
CO2H
Conc. HNO3 + H2SO4/Δ
CO2H
O2N
NO2
SOCl2
COCl
O2N
NO2
NH3
CONH2
O2N
NO2
Br2 + OH–
NH2
O2N
NO2
NaNO2 + HCl
0–5°C
+
N2Cl–
O2N
NO2
H2O/Δ
OH
O2N
NO2