# JEE Adv. May 2025

## Question Paper With Text Solution

## 18 May | Paper-1

# CHEMISTRY

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

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);
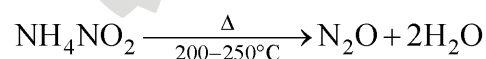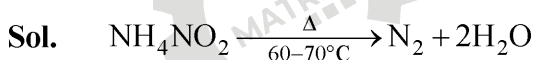
Negative Marks : −1 In all other cases.

1. The heating of $NH_4NO_2$ at 60-70° C and $NH_4NO_3$ at 200-250°C is associated with the formation of nitrogen containing compounds X and Y, respectively. X and Y, respectively, are

   (A) $N_2$ and $N_2O$     (B) $NH_3$ and $NO_2$     (C) $NO$ and $N_2O$     (D) $N_2$ and $NH_3$

   $NH_4NO_2$ का 60-70° C पर तथा $NH_4NO_3$ का 200-250°C पर तापन (heating) नाइट्रोजन युक्त यौगिकों क्रमशः X तथा Y के निर्माण से सम्बन्धित है। X तथा Y क्रमशः हैं

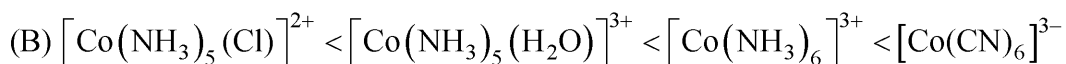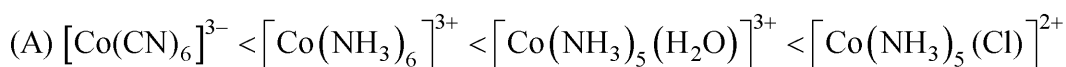   (A) $N_2$ तथा $N_2O$     (B) $NH_3$ तथा $NO_2$     (C) $NO$ तथा $N_2O$     (D) $N_2$ तथा $NH_3$

**Ans.** A

**Sol.**
$$NH_4NO_2 \xrightarrow[\;60-70°C\;]{\Delta} N_2 + 2H_2O$$

$$NH_4NO_2 \xrightarrow[\;200-250°C\;]{\Delta} N_2O + 2H_2O$$

2. The correct order of the wavelength maxima of the absorption band in the ultraviolet-visible region for the given complexes is
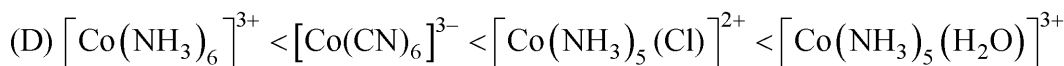
   दिए संकुलों (complexes) के पराबैंगनी–दृश्य (ultraviole-visible) क्षेत्र में अवशोषण–बैन्ड (absorption band) के उच्चिष्ठ तरंगदैर्घ्य (wavelength maxima) का सही क्रम है

   (A) $\left[Co(CN)_6\right]^{3-} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(NH_3)_5(H_2O)\right]^{3+} < \left[Co(NH_3)_5(Cl)\right]^{2+}$

   (B) $\left[Co(NH_3)_5(Cl)\right]^{2+} < \left[Co(NH_3)_5(H_2O)\right]^{3+} < \left[Co(NH_3)_6\right]^{3+} < \left[Co(CN)_6\right]^{3-}$

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(C) $\left[Co(CN)_6\right]^{3-} < \left[Co\left(NH_3\right)_5(Cl)\right]^{2+} < \left[Co\left(NH_3\right)_5\left(H_2O\right)\right]^{3+} < \left[Co\left(NH_3\right)_6\right]^{3+}$

(D) $\left[Co\left(NH_3\right)_6\right]^{3+} < \left[Co(CN)_6\right]^{3-} < \left[Co\left(NH_3\right)_5(Cl)\right]^{2+} < \left[Co\left(NH_3\right)_5\left(H_2O\right)\right]^{3+}$
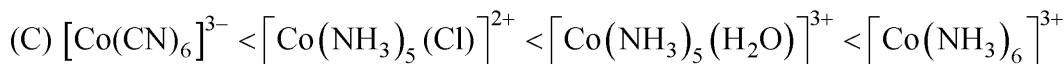
**Ans.** A

**Sol.** $\Delta \propto \dfrac{1}{\lambda}$

* On increasing ligand strength $\Delta \uparrow \lambda \downarrow$

* ligand strength according to spectrochemical series :- $CN^- > NH_3 > H_2O > Cl^-$

Then the correct order of the wavelength maxima of the absorption bond in the U–V region is :-

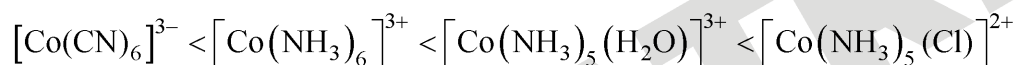$\left[Co(CN)_6\right]^{3-} < \left[Co\left(NH_3\right)_6\right]^{3+} < \left[Co\left(NH_3\right)_5\left(H_2O\right)\right]^{3+} < \left[Co\left(NH_3\right)_5(Cl)\right]^{2+}$
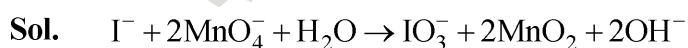
3. One of the products formed from the reaction of permanganate ion with iodide ion in neutral aqueous medium is

उदासीन जलीय माध्यम (neutral aqueous medium) में परमैन्गनेट आयन की आयोडाइड आयन से अभिक्रिया से बने उत्पादों में एक है ।
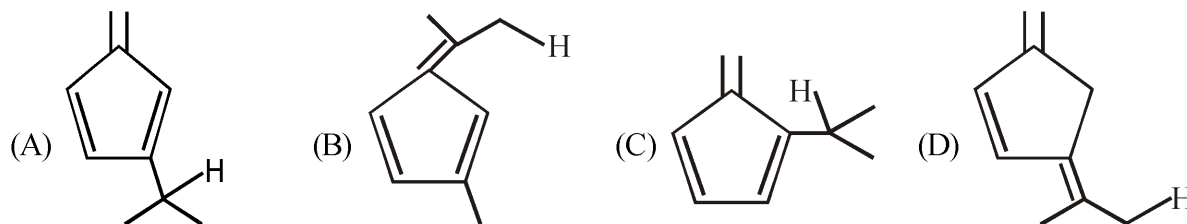
(A) $I_2$      (B) $IO_3^-$      (C) $IO_4^-$      (D) $IO_2^-$

**Ans.** B

**Sol.** $I^- + 2MnO_4^- + H_2O \rightarrow IO_3^- + 2MnO_2 + 2OH^-$

4. Consider the depicted hydrogen (H) in the hydrocarbons given below. The most acidic hydrogen (H) is

नीचे दिए गये हाइड्रोकार्बनों में चिन्हित हाइड्रोजन (H) पर विचार करें । सर्वाधिक अम्लीय हाइड्रोजन (H) है

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**Ans.** B

**Sol.** Acidic strength $\propto$ stability of conjugate base following conjugate bases are formed



(I)        (II)        (III)        (IV)
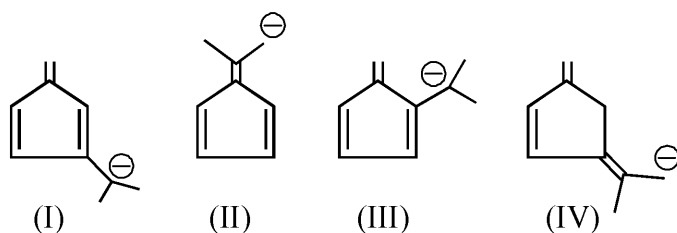
In Above Conjugate bases (II) is most stable, because it will be come Aromatic After Resonance
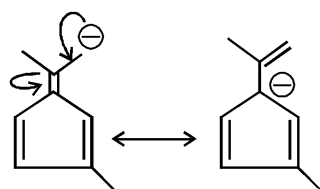


## SECTION 2 (Maximum Marks: 12)

- 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 mark;
  choosing ONLY (B) will get +1 mark;
  choosing ONLY (D) will get +1 mark;
  choosing no option (i.e. the question is unanswered) will get 0 marks; and choosing any other combination of

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options will get -2 marks.

5. Regarding the molecular orbital (MO) energy levels for homonuclear diatomic molecules, the INCORRECT statement(s) is(are)
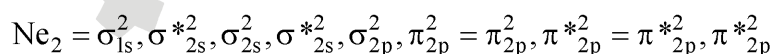
(A) Bond order of $Ne_2$ is zero.

(B) The highest occupied molecular orbital (HOMO) of $F_2$ is $\sigma$-type.

(C) Bond energy of $O_2^+$ is smaller than the bond energy of $O_2$.

(D) Bond length of $Li_2$ is larger than the bond length of $B_2$

समनाभिकी द्विपरमाणुक (homonuclear diatomic) अणुओं के आण्विक कक्ष (molecular orbital (MO)) के ऊर्जा स्तरों के विषय में गलत कथन है / हैं

(A) $Ne_2$ की आबंध कोटि (bond order) शून्य है।

(B) $F_2$ का उच्चतम अध्यासित आण्विक कक्ष (highest occupied molecular orbital (HOMO)) $\sigma$-प्ररूप है।

(C) $O_2^+$ की आबंध ऊर्जा (Bond energy) $O_2$ की आबंध ऊर्जा से कम है।

(D) $Li_2$ की आबंध लम्बाई (bond length) $B_2$ की आबंध लम्बाई से बड़ी है।

**Ans.** B,C

**Sol.** (A) Bond order of $Ne_2 = O$

$$Ne_2 = \sigma_{1s}^2, \sigma*_{2s}^2, \sigma_{2s}^2, \sigma*_{2s}^2, \sigma_{2p}^2, \pi_{2p}^2 = \pi_{2p}^2, \pi*_{2p}^2 = \pi*_{2p}^2, \pi*_{2p}^2$$

$$B.O. = \frac{N_B - N_{AB}}{2}$$

where , $N_B$ = Total number of bonding electrons

$N_{AB}$ = Total number of antibonding electrons

(B) HOMO of $F_2$ is $\pi_{2p}^*$

(C) Bond energy $\propto$ bond order

$$B.O., O_2^+ = 2.5, O_2 = 2.0$$

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bond energy :- $O_2^+ > O_2$

(D) Bond length :- $Li_2 > B_2$ (Acc. so size)

6. The pair(s) of diamagnetic ions is(are)

प्रतिचुम्बकीय (diamagnetic) आयनों का / के युग्म है / हैं

(A) $La^{3+}$, $Ce^{4+}$      (B) $Yb^{2+}$, $Lu^{3+}$      (C) $La^{2+}$, $Ce^{3+}$      (D) $Yb^{3+}$, $Lu^{2+}$

**Ans.** A,B

**Sol.**

| Ions | Electronic configuration | No. of unpaired electrons |
|------|--------------------------|---------------------------|
| $La^{3+}$ | $[Xe]4f^o 5d^o 6s^o$ | O |
| $Ce^{4+}$ | $[Xe]4f^o 5d^o 6s^o$ | O |
| $Ce^{3+}$ | $[Xe]4f^1 5d^o 6s^o$ | 1 |
| $La^{2+}$ | $[Xe]4f^0 5d^1 6s^o$ | 1 |
| $Yb^{2+}$ | $[Xe]4f^{14} 5d^o 6s^o$ | O |
| $Yb^{3+}$ | $[Xe]4f^{13} 5d^o 6s^o$ | 1 |
| $Lu^{2+}$ | $[Xe]4f^{14} 5d^1 6s$ | 1 |
| $Lu^{3+}$ | $[Xe]4f^{14} 5d^o 6s^o$ | O |

7. For the reaction sequence given below, the correct statement(s) is(are)

नीचे दिए गये अभिक्रिया के अनुक्रमों के लिए, सही कथन है / हैं –

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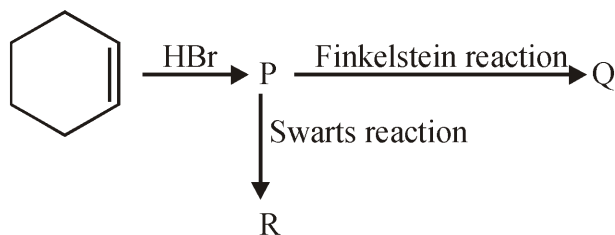
In the options, X is any atom other than carbon and hydrogen, and it is different in P, Q and R)

विकल्पों में X कार्बन और हाइड्रोजन के अलावा कोई परमाणु है तथा यह P, Q तथा R में भिन्न–भिन्न है।)

(Finkelstein reaction : फिंकेल्स्टाइन अभिक्रिया Swarts reaction : स्वार्ट्स अभिक्रिया)

(A) C-X bond length in P, Q and R follows the order Q > R > P.

(B) C-X bond enthalpy in P, Q and R follows the order R > P > Q.

(C) Relative reactivity toward $S_N2$ reaction in P, Q and R follows the order P > R > Q.

(D) value of the conjugate acids of the leaving groups in P, Q and R follows the order R > Q > P.

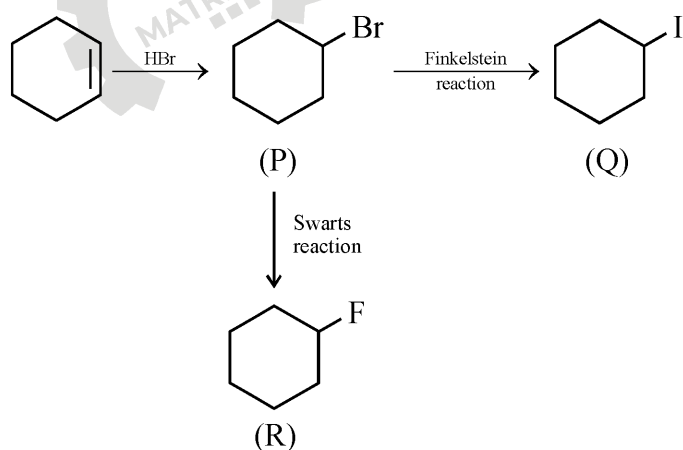(A) P, Q और R में C-X आबंध लम्बाई (bond length) Q > R > P क्रम का अनुगमन करती है।

(B) P, Q और R में C-X आबन्ध एन्थैल्पी (bond enthalpy) R > P > Q क्रम का अनुगमन करती है।

(C) P, Q और R की $S_N2$ अभिक्रिया की सापेक्षिक अभिक्रियाशीलता P > R > Q क्रम का अनुगमन करती है।

(D) P, Q और R के अवशिष्ट समूहों (leaving groups) के संयुग्मित (conjugate) अम्लों के $pK_a$ के मान R > Q > P क्रम का अनुगमन करते हैं।

**Ans.** B

**Sol.**

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(A) C – X Bond length in P, Q, R

R – I > R – Br > R – Cl > R – F

Q > P > R

(B) As Bond length ↑, Bond enthalpy ↓ Q < P < R

(C) Reactivity of $SN^2 \propto$ l.g. ability Q > P > R

(D) Conjugate Acids of leaving groups are HI, HBr and HF.

$Ka \Rightarrow HI > HBr > HF$

$P^{ka} \Rightarrow HI < HBr < HF$ (Q<P<R)

## SECTION 3 (Maximum Marks: 24)

- This section contains **SIX (06)** questions.
- The answer to each question is a **NUMERICAL VALUE.**
- For each question, enter the correct integer corresponding to the answer using the mouse and the onscreen virtual numeric keypad in the place designated to enter the answer.
- If the numerical value has more than two decimal places, **truncate/round-off** the value to **TWO** decimal places.
- Answer to each question will be evaluated <u>according to the following marking scheme</u>:
  Full Marks : +4 If **ONLY** the correct integer is entered;
  Zero Marks : 0 In all other cases.

8. In an electrochemical cell, dichromate ions in aqueous acidic medium are reduced to $Cr^{3+}$. The current (in amperes) that flows through the cell for 48.25 minutes to produce 1 mole of $Cr^{3+}$ is _____.

   Use: 1 Faraday = 96500 C mol⁻¹

   एक विद्युत–रासायनिक (electrochemical) सेल में डाइक्रोमेट आयन जलीय अम्लीय माध्यम में $Cr^{3+}$ में अपचयित होते हैं। 1 मोल $Cr^{3+}$ उत्पन्न करने हेतु धारा (current, amperes में) जो 48.25 मिनट तक सेल में प्रवाहित हो, _____ है।

   उपयोग करें : 1 फैरेडे = 96500 C mol⁻¹

**Ans.** 100

**Sol.** $Cr_2O_7^{2-} \longrightarrow Cr^{3+} \left(n_f = 3\right)$

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$Q = n \times n_f \times F$

$\Rightarrow I \times 48.25 \times 60 = 1 \times 3 \times 96500$

$\Rightarrow I = 100$ ampere

9. At 25 °C, the concentration of $H^+$ ions in $1.00 \times 10^{-3}$ M aqueous solution of a weak monobasic acid having acid dissociation constant $\left(K_a\right)$ of $4.00 \times 10^{-11}$ is $X \times 10^{-7}$ M. The value of X is ———.

Use: Ionic product of water $\left(K_w\right) = 1.00 \times 10^{-14}$ at 25 °C _____.

25 °C पर एक दुर्बल एकक्षारकी अम्ल, जिसकाअम्ल विघटन नियतांक (acid dissociation constant $\left(K_a\right)$) $4.00 \times 10^{-11}$ है, के एक $1.00 \times 10^{-3}$ M जलीय विलयन में $H^+$ आयन की सान्द्रता $X \times 10^{-7}$ M है। X का मान ——— है।

उपयोग करें : 25 °C पर जल का आयनी गुणनफल $\left(K_w\right) = 1.00 \times 10^{-14}$

**Ans.** 2.20 to 2.25

**Sol.** $\left[H^+\right] = \sqrt{k_a C + k_w}$

$= \sqrt{\left(4 \times 10^{-11} \times 1 \times 10^{-3}\right) + 10^{-14}}$

$= \sqrt{5} \times 10^{-7}$

$x = \sqrt{5} = 2.236$

10. Molar volume $\left(V_m\right)$ of a van der Waals gas can be calculated by expressing the van der Waals equation as a cubic equation with $V_m$ as the variable. The ratio (in mol dm$^{-3}$) of the coefficient of $V_m^2$ to the coefficient of $V_m$ for a gas having van der Waals constants a = 6.0 dm$^6$ atm mol$^{-2}$ and b = 0.060 dm$^3$ mol$^{-1}$ at 300 K and 300 atm is _____

Use: Universal gas constant (R) = 0.082 dm$^3$ atm mol$^{-1}$ K$^{-1}$ _____.

एक वॉन डर वाल्स (van der Waals) गैस के मोलर आयतन (Molar volume $\left(V_m\right)$) का परिकलन वॉन डर वाल्स समीकरण को एक त्रिघात समीकरण (cubic equation) जिसमें $V_m$ चर ( variable) है. में व्यक्त कर के कर सकते हैं । एक गैस जिसके वॉन डर वाल्स स्थिरांक a = 6.0 dm$^6$ atm mol$^{-2}$ तथा b = 0.060 dm$^3$ mol$^{-1}$ हैं, के 300 K तथा 300 atm पर $V_m^2$ के गुणांक तथा $V_m$

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के गुणांक का अनुपात (mol dm⁻³ में) _____ है ।

उपयोग करें : सार्वत्रिक गैस नियातंक (Universal gas constant (R) = 0.082 dm³ atm mol⁻¹ K⁻¹

**Ans.** −7.10

**Sol.** $$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$$

$$PV_m - P_b + \frac{a}{V_m} - \frac{a_b}{V_m^2} = RT$$

$$PV_m^3 + (-P_b - Rt)V_m^2 + aV_m - ab = 0$$

$$V_m^3 + \left(-b - \frac{RT}{P}\right)V_m^2 + \frac{a}{P}V_m - \frac{a_b}{P} = 0$$

$$\Rightarrow \frac{\text{Coeff of } V_m^2}{\text{Coeff of } V_m} = \frac{-\left(0.060 + \frac{0.082 \times 300}{300}\right)}{6/300}$$

Answer = − 7.10

11. Considering ideal gas behavior, the expansion work done (in kJ) when 144 g of water is electrolyzed completely under constant pressure at 300 K is _____.

   Use: Universal gas constant (R) = 8.3 J K⁻¹ mol⁻¹; Atomic mass (in amu): H = 1, O = 16 _____.

   आदर्श गैस व्यवहार मानते हुए, 300 K तथा स्थिर दाब पर 144 g जल के सम्पूर्ण विद्युत अपघटित (electrolyzed) होने पर किया हुए अप्रसरण कार्य (expansion work done (kJ में) _____ है ।

   उपयोग करें: सार्वत्रिक गैस नियातंक (Universal gas constant (R) = 8.3 J K⁻¹ mol⁻¹; परमाणु द्रव्यमान (Atomic mass (in amu में): H = 1, O = 16

**Ans.** 29.88 kJ

**Sol.** $$H_2O(\ell) \longrightarrow H_2(g) + \frac{1}{2}O_2(g)$$

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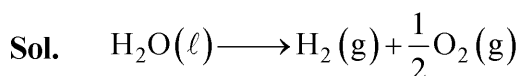
$$\Delta n_g = \frac{3}{2} \times \frac{144}{18}$$

$$w = -\Delta n_g RT$$

$$= -\frac{3}{2} \times \frac{144}{18} \times 8.3 \times 300$$

Ans $= 29.88$ kJ

12. The monomer (X) involved in the synthesis of Nylon 6,6 gives positive carbylamine test. If 10 moles of X are analyzed using Dumas method, the amount (in grams) of nitrogen gas evolved is _____.

Use: Atomic mass of N (in amu) = 14 _____.

नायलॉन 6,6 (Nylon 6,6) के संश्लेषण में शामिल एकलक (monomer) (X). सकारात्मक कार्बिलऐमीन (carbylamine) परीक्षण देता है। यदि डुमास (Dumas) विधि से 10 मोल X विश्लेषित किया जाये, तो उत्पन्न हुए नाइट्रोजन गैस की मात्रा (ग्राम में) _____ है।

उपयोग करें: N का परमाणु द्रव्यमान (atomic mass, amu में) = 14 _____.

**Ans.** 280

**Sol.** Monomer of Nylon 6,6 is Adipic Acid and Hexamethylene Diamine

$$\underset{\text{10 mole}}{H_2 N - (CH_2)_6 NH_2} \xrightarrow[\text{method}]{\text{Duma}} \underset{\text{10 mole}}{N_2(g)}$$

On reaction of 10 moles of Hexamethylene Diamine, will get 10 moles of $N_2$ (As per P.O.A.C.)

Mass of $N_2$ evolved = 280 gm.

13. The reaction sequence given below is carried out with 16 moles of X. The yield of the major product in each step is given below the product in parentheses. The amount (in grams) of S produced is _____.
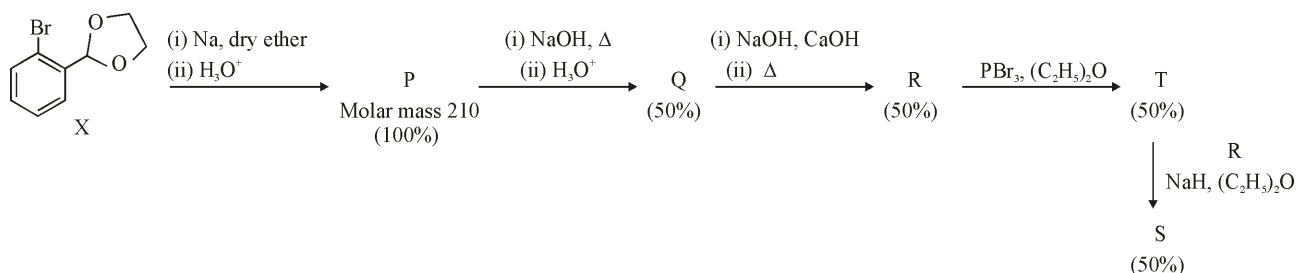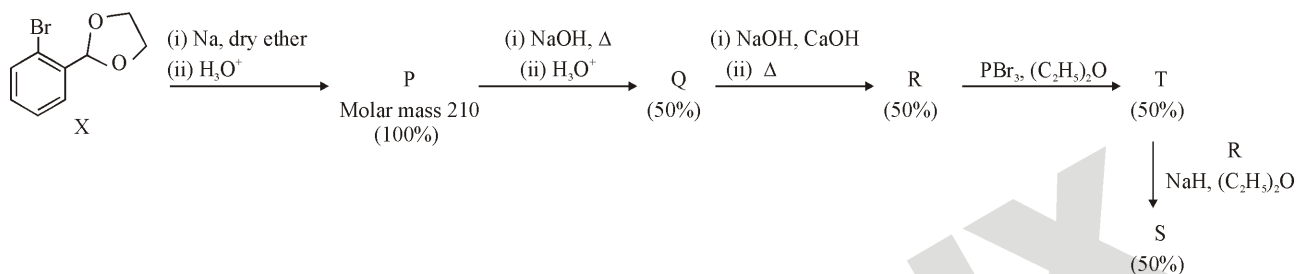
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Use: Atomic mass (in amu): H = 1, C = 12, O = 16, Br = 80

नीचे दिये गये अभिक्रिया अनुक्रम को X के 16 मोल्स के साथ प्रतिपादित (carried out) किया जाता है। प्रत्येक पद के लिये प्रमुख उत्पाद उपज (yield) उत्पाद के नीचे कोष्ठक में दी गयी है। उत्पन्न हुयी S की मात्रा (ग्राम में) _____ है।.
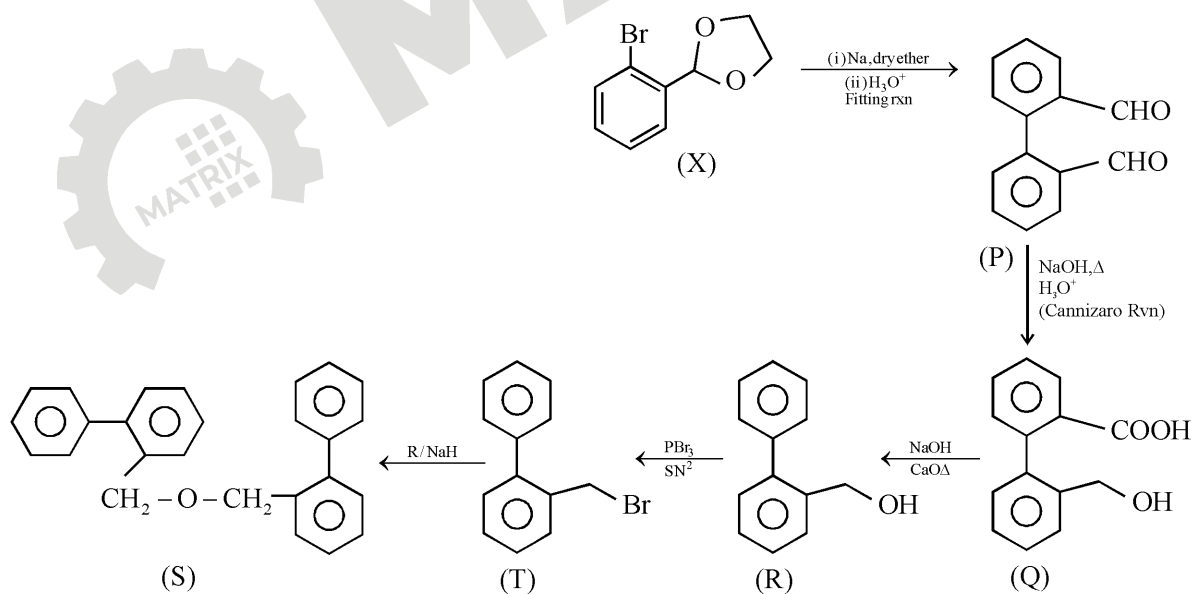


(dry ether : शुष्क ईथर molar mass: मोलर द्रव्यमान)

उपयोग करें : परमाणु द्रव्यमान (Atomic mass (amu में) : H = 1, C = 12, O = 16, Br = 80

**Ans.** 175

**Sol.**

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moles of "X" given 16 moles

moles of "P" formed = 8 moles (because of dimerisation it will become half)

moles of Q = 4 (because of 50% yield)

moles of R = 2 (because of 50% yield)

moles of T = 1 (because of 50% yield)

moles of S = 0.5 (because of 50% yield)

Amount of "S" (in gm) = mole X molar mass = $\frac{1}{2} \times 350 = 175$

## SECTION 4 (Maximum Marks: 12)
- This section contains **THREE (03)** 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 : +4 **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. The correct match of the group reagents in List-I for precipitating the metal ion given in List-II from solutions, is

List-I | List-II

(P) Passing $H_2S$ in the presence of $NH_4OH$ | (1) $Cu^{2+}$

(Q) $(NH_4)_2CO_3$ in the presence of $NH_4OH$ | (2) $Al^{3+}$

(R) $NH_4OH$ in the presence of $NH_4Cl$ | (3) $Mn^{2+}$

(S) Passing $H_2S$ in the presence of dilute HCl | (4) $Ba^{2+}$

(5) $Mg^{2+}$

सूची-I में दिए समूह अभिकर्मकों (group reagents) जो सूची-II में दिये गये धातु आयन का विलयन से अवक्षेपण करें, का सही सुमेल है ।

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| सूची-I | सूची-II |
|---|---|
| (P) $NH_4OH$ की उपस्थिति में $H_2S$ प्रवाहित | (1) $Cu^{2+}$ |
| (Q) $NH_4OH$ की उपस्थिति में $(NH_4)_2 CO_3$ | (2) $Al^{3+}$ |
| (R) $NH_4Cl$ की उपस्थिति में $NH_4OH$ | (3) $Mn^{2+}$ |
| (S) तनु HCl की उपस्थिति में $H_2S$ | (4) $Ba^{2+}$ |
| | (5) $Mg^{2+}$ |

(A) $P \rightarrow 3; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 1$   (B) $P \rightarrow 4; Q \rightarrow 2; R \rightarrow 3; S \rightarrow 1$

(C) $P \rightarrow 3; Q \rightarrow 4; R \rightarrow 1; S \rightarrow 5$   (D) $P \rightarrow 5; Q \rightarrow 3; R \rightarrow 2; S \rightarrow 4$

**Ans.** A

**Sol.**

| List-I | List-II |
|---|---|
| Group Reagent | Group cation (PPTD) |
| (P) $\begin{array}{l} H_2S + NH_4OH \\ (group\ IV) \end{array}$ | (3) $Mn^{2+} + group\ I + II + III$ |
| (Q) $\begin{array}{l} (NH_4)_2 CO_3 + NH_4OH \\ (group\ V) \end{array}$ | (4) $Ba^{2+} + group\ I + II + III + IV$ |
| (R) $\begin{array}{l} NH_4OH + NH_4Cl \\ (group\ III) \end{array}$ | (2) $Al^{3+} + group\ I + II$ |
| (S) $\begin{array}{l} H_2S + HCl \\ (group\ II) \end{array}$ | (1) $Cu^{2+} + group\ I$ |

15. The major products obtained from the reactions in List-II are the reactants for the named reactions mentioned in List-I. Match each entry in List-I with the appropriate entry in List-II and choose the correct option.
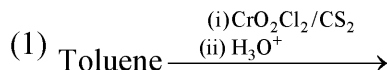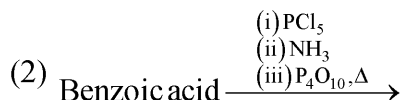
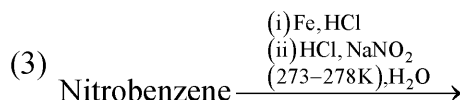List-I                                       List-II
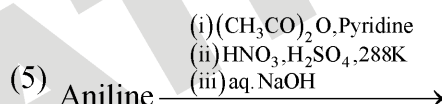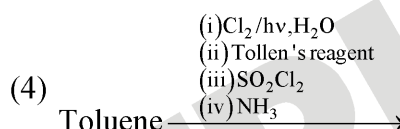
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(P) Stephen reaction

(1) Toluene $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i)} CrO_2Cl_2/CS_2}$

(Q) Sandmeyer reaction

(2) Benzoic acid $\xrightarrow[\text{(iii)} P_4O_{10}, \Delta]{\substack{\text{(i)} PCl_5 \\ \text{(ii)} NH_3}}$

(R) Hoffmann bromamide degradation reaction

(3) Nitrobenzene $\xrightarrow[\text{(273–278K)}, H_2O]{\substack{\text{(i)} Fe, HCl \\ \text{(ii)} HCl, NaNO_2}}$

(S) Cannizzaro reaction

(4) Toluene $\xrightarrow[\text{(iv)} NH_3]{\substack{\text{(i)} Cl_2/hv, H_2O \\ \text{(ii)} Tollen's\ reagent \\ \text{(iii)} SO_2Cl_2}}$

(5) Aniline $\xrightarrow[\text{(iii)} aq.\ NaOH]{\substack{\text{(i)} (CH_3CO)_2O, Pyridine \\ \text{(ii)} HNO_3, H_2SO_4, 288K}}$

सूची-II में दी गयी अभिक्रियाओं से उत्पन्न हुए प्रमुख उत्पाद सूची-I में उल्लेखित नामित (named) अभिक्रियाओं के अभिकाकर है। सूची-I में दी गयी प्रत्येक प्रविष्टि को सूची-II की उपयुक्त प्रविष्टि से सुमेल करें और उचित विकल्प को चुनें।
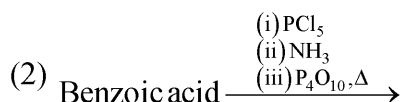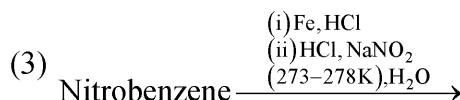
सूची-I

सूची-II

(P) स्टीफेन अभिक्रिया (Stephen reaction)

(1) Toluene $\xrightarrow[\text{(ii) } H_3O^+]{\text{(i)} CrO_2Cl_2/CS_2}$
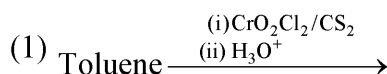
(Q) सैन्डमायर अभिक्रिया (Sandmeyer reaction)

(2) Benzoic acid $\xrightarrow[\text{(iii)} P_4O_{10}, \Delta]{\substack{\text{(i)} PCl_5 \\ \text{(ii)} NH_3}}$

(R) हॉफमान ब्रोमामाइड निम्नीकरण अभिक्रिया

(3) Nitrobenzene $\xrightarrow[\text{(273–278K)}, H_2O]{\substack{\text{(i)} Fe, HCl \\ \text{(ii)} HCl, NaNO_2}}$
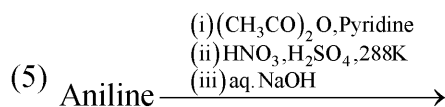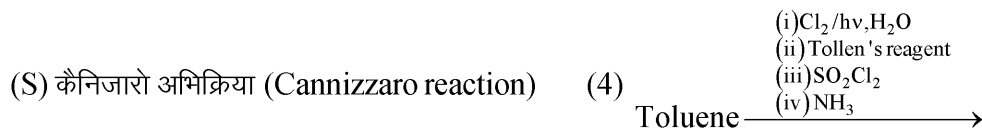
(Hoffmann bromamide degradation reaction)

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(S) कैनिजारो अभिक्रिया (Cannizzaro reaction)　　(4) Toluene $\xrightarrow{\begin{array}{l}(i)Cl_2/hv,H_2O\\(ii)Tollen's\ reagent\\(iii)SO_2Cl_2\\(iv)NH_3\end{array}}$

(5) Aniline $\xrightarrow{\begin{array}{l}(i)(CH_3CO)_2O,Pyridine\\(ii)HNO_3,H_2SO_4,288K\\(iii)aq.NaOH\end{array}}$

(Toluene: टॉलूइन, Benzoic acid: बेन्जोइक अम्ल, Nitrobenzene: नाइट्रोबेन्जीन, Aniline : ऐनिलीन, Tollen's reagent : टॉलेन अभिकर्मक, aq. NaOH : जलीय NaOH)

(A) $P \rightarrow 2; Q \rightarrow 4; R \rightarrow 1; S \rightarrow 3$　　　　(B) $P \rightarrow 2; Q \rightarrow 3; R \rightarrow 4; S \rightarrow 1$

(C) $P \rightarrow 5; Q \rightarrow 3; R \rightarrow 4; S \rightarrow 2$　　　　(D) $P \rightarrow 5; Q \rightarrow 4; R \rightarrow 2; S \rightarrow 1$

**Ans.** B

**Sol.**　　Reaction Name　　　　　　　　　　Initial reactant taken
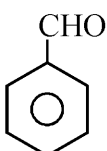
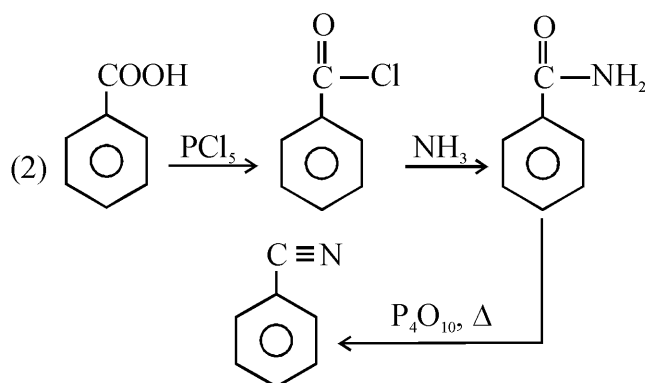(P) Stephen Reaction　　　　　　　　　　R–CN

(Q) Sandmeyer reaction　　　　　　　　$Ph - N_2^{\oplus}$ OR $PH-NH_2$

(R) Hoffmann bromamide degradation reaction　　　$R - \overset{\overset{\displaystyle O}{\|}}{C} - NH_2$
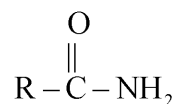
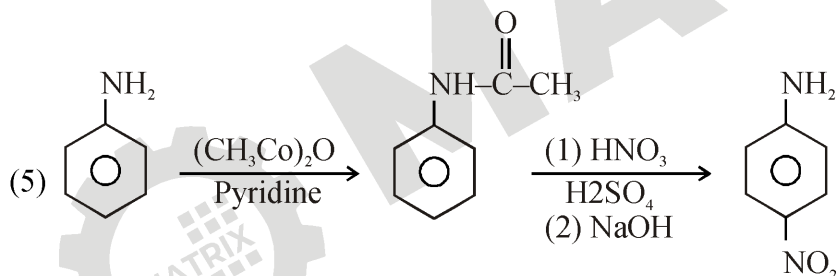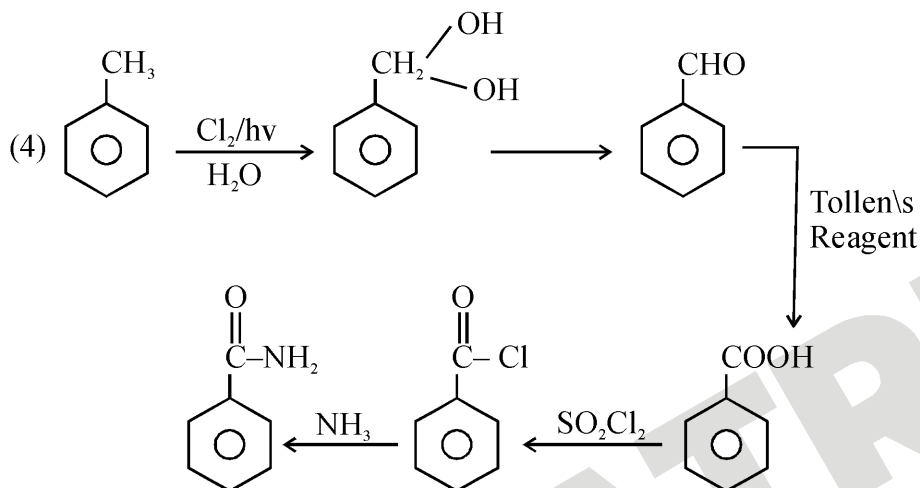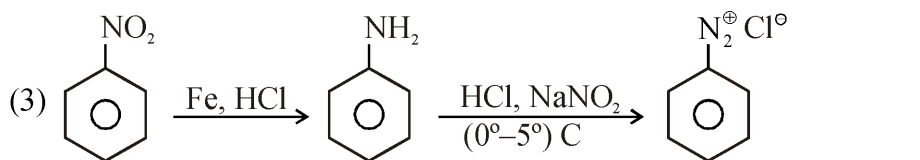(S) Cannizaro　　　　　　　　　　　　$R - CHO$ OR $Ph - CHO$ (With $\alpha- H$)

(1) It is etard rection , so product is



(2)

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(3) Benzene with $NO_2$ group
$\xrightarrow{\text{Fe, HCl}}$ Benzene with $NH_2$ group
$\xrightarrow[(0°-5°)\,C]{\text{HCl, NaNO}_2}$ Benzene with $N_2^{\oplus}\,Cl^{\ominus}$ group

(4) Toluene ($CH_3$)
$\xrightarrow[H_2O]{Cl_2/hv}$ Benzene with $CH_2\begin{smallmatrix}OH\\OH\end{smallmatrix}$ group
$\longrightarrow$ Benzaldehyde (CHO)
$\xrightarrow{\text{Tollen\s Reagent}}$ Benzoic acid (COOH)
$\xrightarrow{SO_2Cl_2}$ Benzoyl chloride ($\overset{O}{\overset{\|}{C}}-Cl$)
$\xrightarrow{NH_3}$ Benzamide ($\overset{O}{\overset{\|}{C}}-NH_2$)

(5) Aniline ($NH_2$)
$\xrightarrow[\text{Pyridine}]{(CH_3Co)_2O}$ Acetanilide ($NH-\overset{O}{\overset{\|}{C}}-CH_3$)
$\xrightarrow[\substack{H2SO_4\\(2)\ NaOH}]{(1)\ HNO_3}$ 4-nitroaniline ($NH_2$ / $NO_2$)
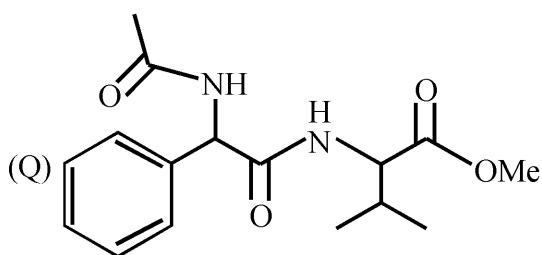
16. Match the compounds in List-I with the appropriate observations in List-II and choose the correct option.
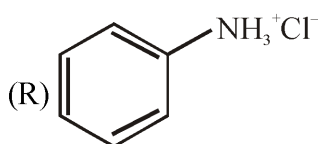
List-I

List-II

(P)
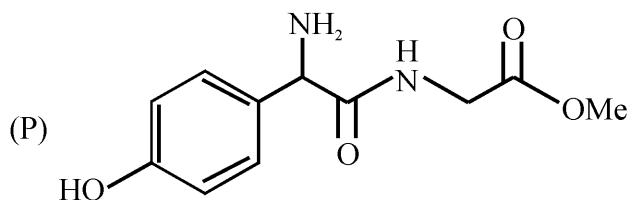


(1) Reaction with phenyl diazonium salt gives
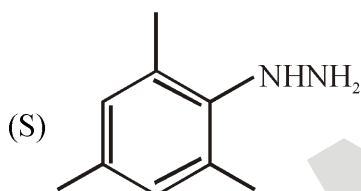
yellow dye.

(Q)



(R)



(S)



(2) Reaction with ninhydrin gives purple color and it also reacts with $FeCl_3$ to give violet color.

(3) Reaction with glucose will give corresponding hydrazone.
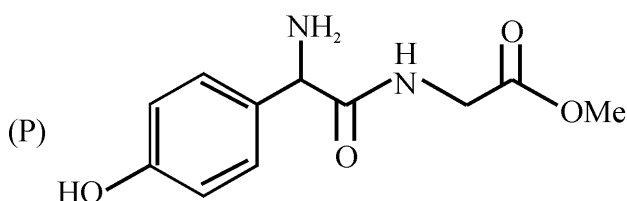
(4) Lassiagne extract of the compound treated with dilute HCl followed by addition of aqueous $FeCl_3$ gives blood red color.

(5) After complete hydrolysis, it will give ninhydrin test and it DOES NOT give positive phthalein dye test.

सूची-I में दिये गये यौगिकों का सूची-II में दिये गये उपयुक्त प्रेक्षणों (observations) से सुमेल करें और उचित विकल्प को चुनें।
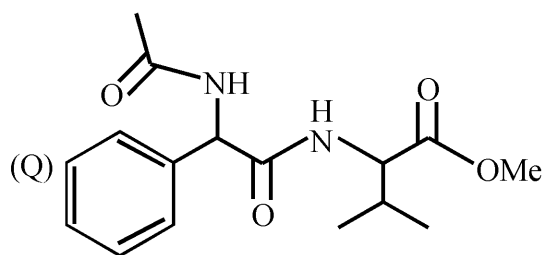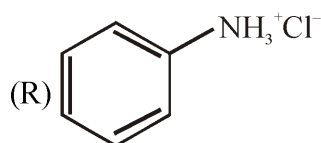
सूची-I

सूची-II

(P)



(1) फिनाइल डाईऐजोनियम (phenyl diazonium)

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लवण की अभिक्रिया पीला रंजक (dye) देती है।
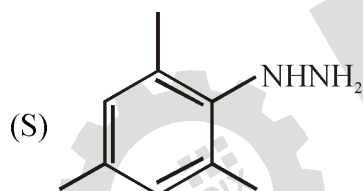

(Q)

(2) निनहाइड्रिन (ninhydrin) के साथ अभिक्रिया

जामुनी (purple) रंग देती है और यह $FeCl_3$ से भी अभिक्रिया करके बैंगनी (violet) रंग देती है।


(R)

(3) ग्लूकोस से अभिक्रिया संगत (corresponding)

हाईड्रैजोन (hydrazone) देगी।


(S)

(4) यौगिक का लैसे निचोड़ (Lassiagne extract)

तनु HCl से विवेचित (treated) करने के बाद जलीय $FeCl_3$ मिलाने पर खूनी लाल रंग देता है।

(5) पूर्णतया जल अपघटन के बाद, यह निनहाइड्रिन (ninhydrin) परीक्षण देगा और यह सकारात्मक थैलीन रंजक (phthalein dye) परीक्षण नहीं देता है।

(A) $P \to 1; Q \to 5; R \to 4; S \to 2$

(B) $P \to 2; Q \to 5; R \to 1; S \to 3$

(C) $P \to 5; Q \to 2; R \to 1; S \to 4$

(D) $P \to 2; Q \to 1; R \to 5; S \to 3$

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**Ans.** B

**Sol.** Aniline or Anilinium salt on Reaction With $Ph-N_2^{\oplus}$, will given yellow dye.
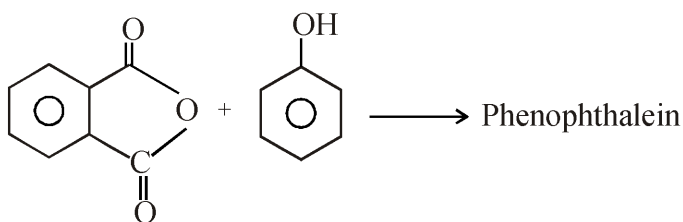
So (R) will Match will (1)

→ In Lassiagne test

$Fe^{3+}+SCN^- \rightarrow$ Blood Red Color
No options have "S" in given compound of so (4) does n't match with anyone

→ Phthalein dye test



→ Nintlydrin test

option "Q" will given Amino Acid After Hydrolysis, but does n't give phthalein test

So will Match with (5)

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