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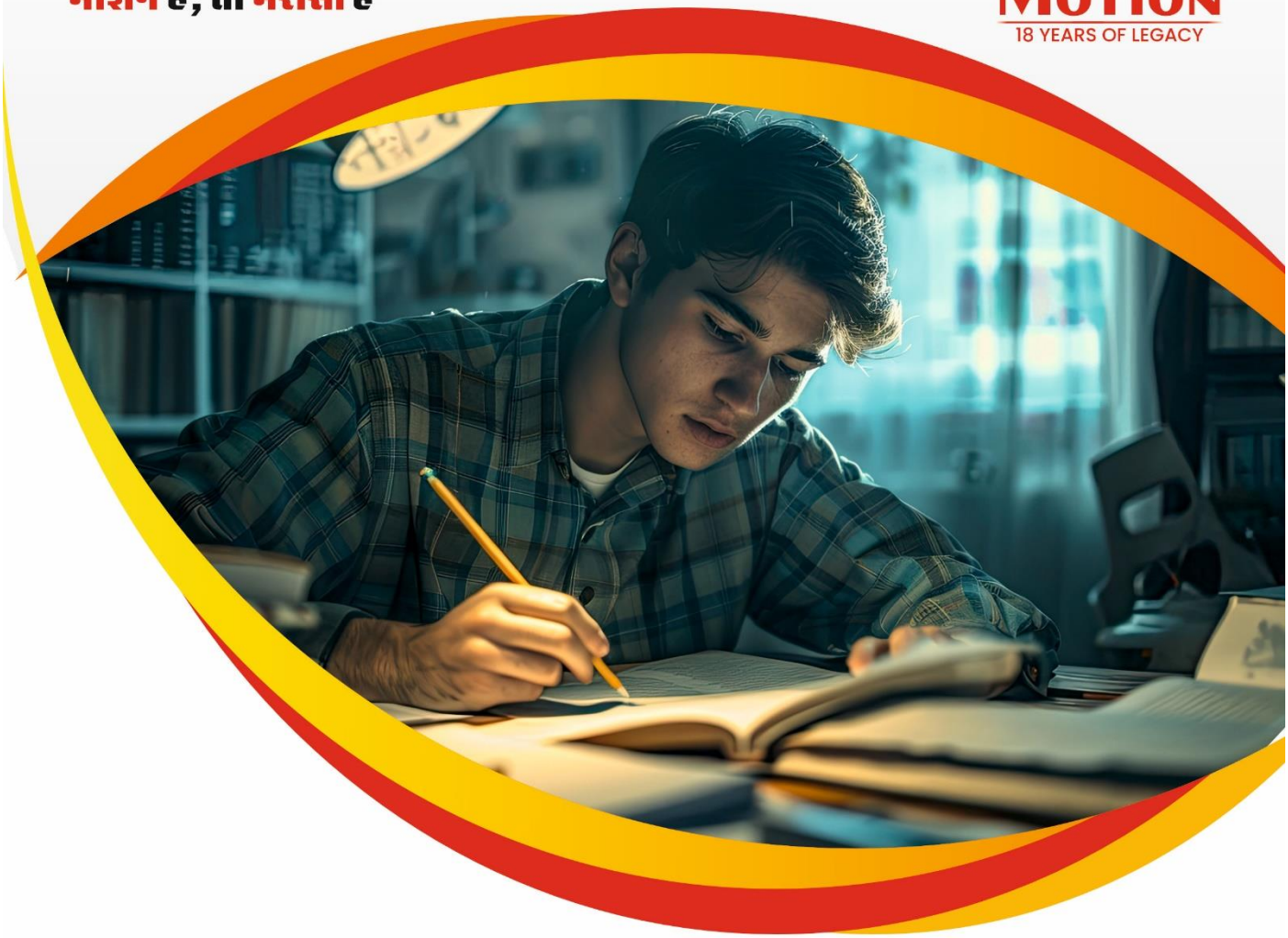
MOTION
18 YEARS OF LEGACY



JEE ADVANCED 2025

QUESTION PAPER WITH SOLUTIONS

CHEMISTRY (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.

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

Sol. **A**

$$NH_4NO_2 \xrightarrow{60-70^\circ C} N_2 + 2H_2O$$

$$NH_4NO_3 \xrightarrow{250^\circ C} N_2O + 2H_2O$$

2. T he correct order of the wavelength maxima of the absorption band in the ultraviolet-visible region for the given complexes is

(A) $[Co(CN)_6]^{3-} < [Co(NH_3)_6]^{3+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_5(Cl)]^{2+}$
(B) $[Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-}$
(C) $[Co(CN)_6]^{3-} < [Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+} < [Co(NH_3)_6]^{3+}$
(D) $[Co(NH_3)_6]^{3+} < [Co(CN)_6]^{3-} < [Co(NH_3)_5(Cl)]^{2+} < [Co(NH_3)_5(H_2O)]^{3+}$

Sol. **A**

WFL containing complex absorbs higher wave length

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

3. O ne of the products formed from the reaction of permanganate ion with iodide ion in neutral aqueous medium is

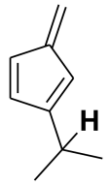
(A) I_2 (B) IO_3^- (C) IO_4^- (D) IO_2^-

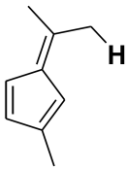
Sol. **B**

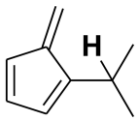
In neutral (or) faintly alkaline (NCERT 12th page Number 108)

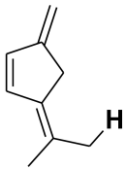
$$2MnO_4^- + H_2O + I^- \rightarrow 2MnO_2 + 2OH^- + IO_3^-$$

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

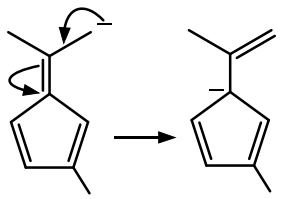
(A) 

(B) 

(C) 

(D) 

Sol. **B**



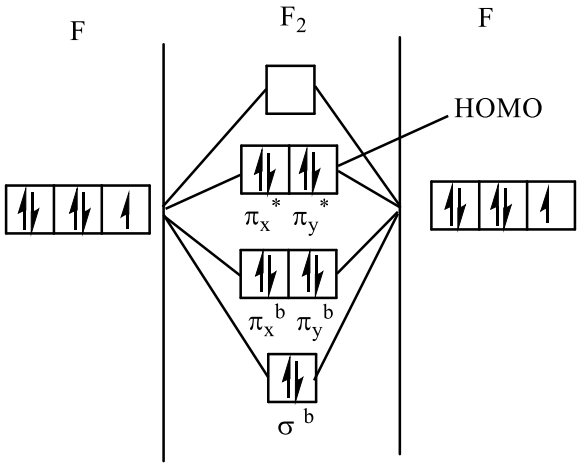
Aromatic

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 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 +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 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 σ-type.
(C) Bond energy of O_2^+ is smaller than the bond energy of O_2.
(D) Bond length of Li2 is larger than the bond length of B2.

Sol. **B & C**



(C) O_2^+ B.O = 2.5 > O_2 2.0.

Bond order ∝ Bond energy

Hence B & C are wrong

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

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

Sol. **A & B**

(A) $La: [Xe]4f^{o}5d^{1}6s^{2}$

$La^{3+}: [Xe]4f^{o}5d^{o}6s^{o} \rightarrow$ Diamagnetic

$Ce: [Xe]4f^{1}5d^{1}6s^{2}$

$Ce^{4+}: [Xe]4f^{o}5d^{o}6s^{o} \rightarrow$ Diamagnetic

(B) $Yb: [Xe]4f^{14}5d^{o}6s^{2}$

$Yb^{2+}: [Xe]4f^{14}5d^{o}6s^{o} \rightarrow$ Diamagnetic

$Lu: [Xe]4f^{14}5d^{1}6s^{2}$

$Lu^{3+}: [Xe]4f^{14}5d^{o}6s^{o} \rightarrow$ Diamagnetic

(C) $La^{2+}: [Xe]4f^{o}5d^{1}6s^{o} \rightarrow$ Paramagnetic

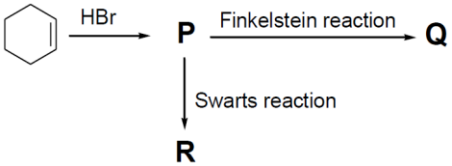
$Ce^{3+}: [Xe]4f^{1}5d^{o}6s^{o} \rightarrow$ Paramagnetic

(D) $Yb^{3+}: [Xe]4f^{13}5d^{o}6s^{o} \rightarrow$ Paramagnetic

$Lu^{2+}: [Xe]4f^{14}5d^{1}6s^{o} \rightarrow$ Paramagnetic

Hence answer is A & B

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



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

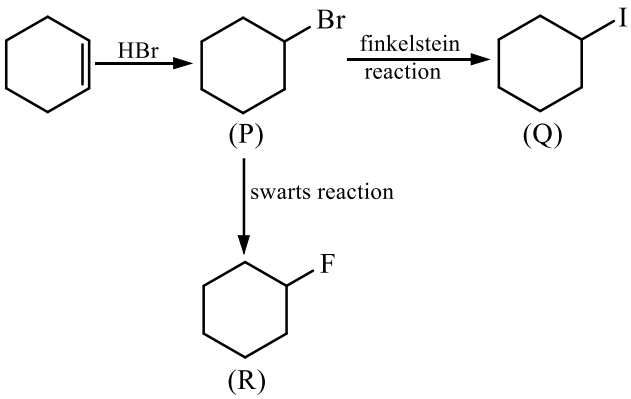
(A) C−X bond length in P, Q and R follows the order Q > R > P.

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

(C) Relative reactivity toward SN2 reaction in P, Q and R follows the order P > R > Q.

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

Sol. **B**



(A) C–X Bond length C–F < C–Br < C–I

R < P < Q

(B) Bond enthalpy C–F > C–Br > C–I

(R) (P) (Q)

(C) Reactivity order toward $SN_2 \rightarrow$ C–F < C–Br < C–I

(R) (P) (Q)

(D) Pk_a order

HF	HBr	HI
3.2	–9	–10

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 numerical value of 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 according to the following marking scheme:
  Full Marks : +4 If ONLY the correct numerical value is entered in the designated place;
  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}

Sol. **100**

t = 48.25 min.

$$6e^- + 14H^+ + Cr_2O_7^{2-} \rightarrow 2Cr^{3+} + 7H_2O$$

For 1 mole $Cr^{3+} = 3$ mole e^-

= 3 F charge required

$$\text{Current} = \frac{q}{t} = \frac{3 \times 96500}{48.25 \times 60} = 100\text{A}$$

9. At 25°C, the concentration of H^+ ions in 1.00×10^{-3} M aqueous solution of a weak monobasic acid having acid dissociation constant (Ka) of 4.00×10^{-11} is $\boldsymbol{X} \times 10^{-7}$ M. The value of $\boldsymbol{X}$ is _____.
Use: Ionic product of water (K_w) = 1.00×10^{-14} at 25°C

Sol. **2.24**

$$HA \rightarrow H^+ + A^-$$

10^{-3} $x + y$ x

$$H_2O \rightarrow H^+ + OH^-$$

$x + y$ y

$$\frac{(x+y)(x)}{10^{-3}} = 4 \times 10^{-11}$$

$x(x+y)=4\times10^{-14}$ .....(1)

$y(x+y)=10^{-14}$ .....(2)

$(x+y)^2=5\times10^{-14}$

$(x+y)=\sqrt{5}\times10^{-7}$

$\left[H^+\right]=2.24\times10^{-7}\,M$

10. Molar volume (V_m) 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 dm3 mol−1 at 300 K and 300 atm is _____.
Use: Universal gas constant (R) = 0.082 dm^3 atm mol^{-1} K^{-1}

Sol. **–7.1**

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

$$PV_m+\frac{a}{V_m}-Pb-\frac{ab}{V_m^2}=RT$$

$$PV_m^3+aV_m-PbV_m^2-ab=RTV_m^2$$

$$PV_m^3-(Pb+RT)V_m^2+aV_m-ab=0$$

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

Ratio of coefficient of V_m^2 to V_m

$$=-\frac{Pb+RT}{a}=-\frac{(300\times0.060)+(0.082\times300)}{6}=-\frac{18+24.6}{6}=-7.1$$

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

Sol. **29.88**

T = 300 K

$$H_2O(\ell)\rightarrow\frac{1}{2}O_2(g)+H_2(g)$$

144 g ↓

8 mole 4 mole 8 mole

$$w=-\Delta n_g RT$$

$$=-(12)\,RT=-(12)\,(8.3)\,(300)=-29.88\ KJ$$

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

Sol. **280**

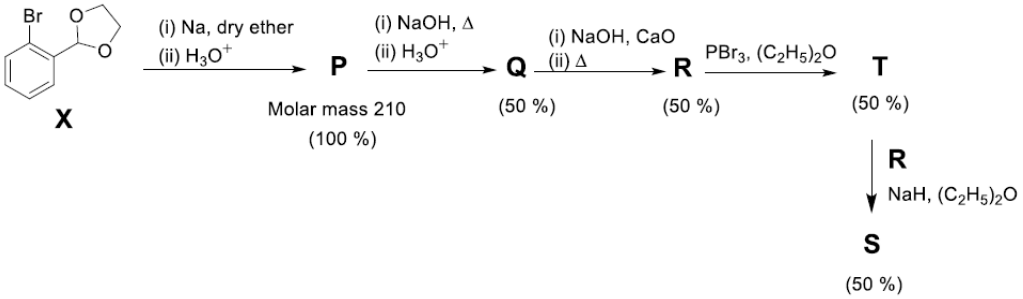
Hexamethylenedianmine, which is monomer of nylon given positive carbylamines test.

$C_6H_{12}(NH_2)_2$

Amount of nitrogen in 10 mole of monomer = 20 mol

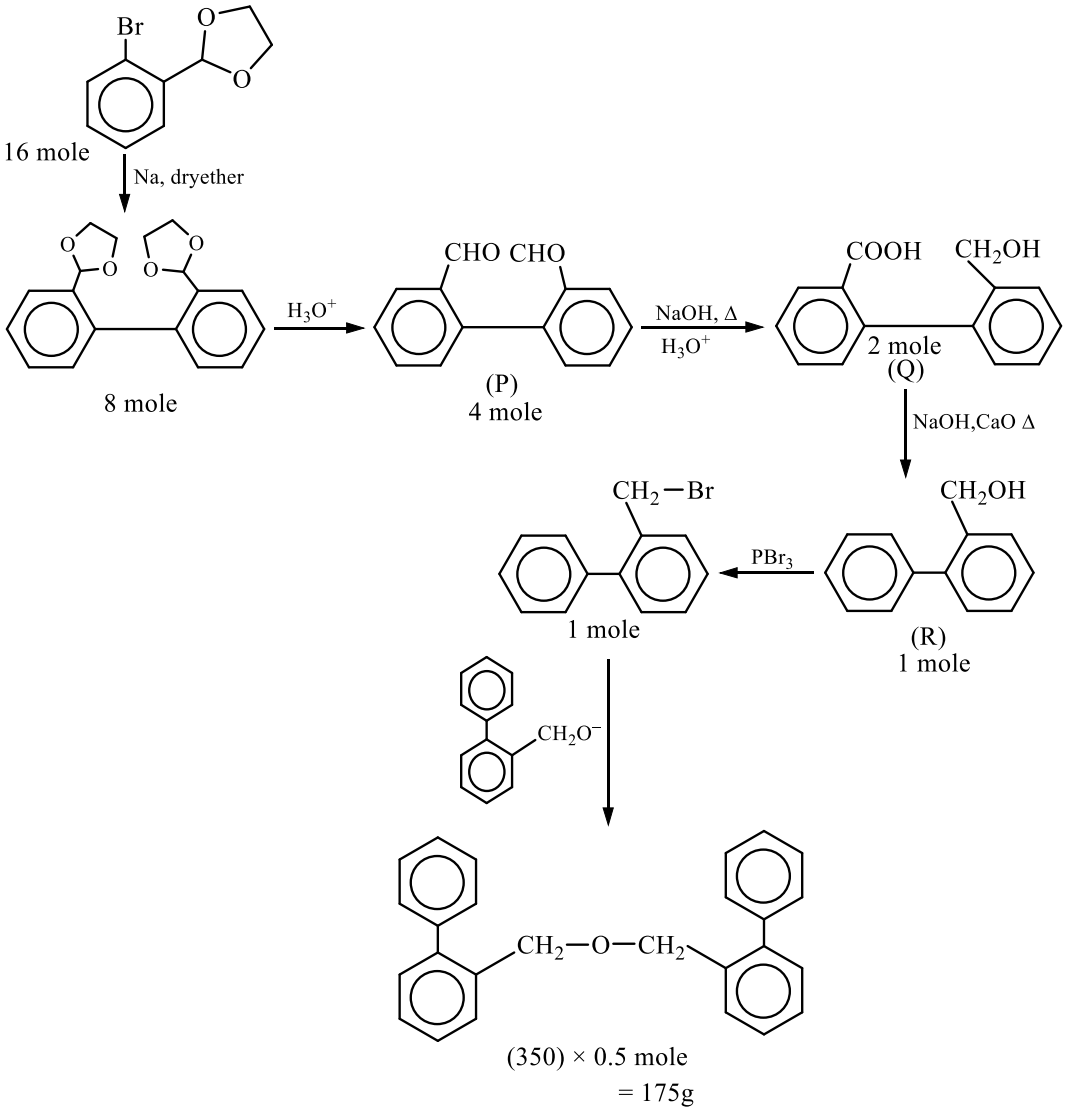
Mass of nitrogen = $20 \times 14 = 280\,gm$

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_____.



Use: Atomic mass (in amu): H = 1, C = 12, O = 16, Br = 80

Sol. **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 according to the following marking scheme:
  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+}

(A) P → 3; Q → 4; R → 2; S → 1
(B) P → 4; Q → 2; R → 3; S → 1
(C) P → 3; Q → 4; R → 1; S → 5
(D) P → 5; Q → 3; R → 2; S → 4

Sol. **A**

P → Passing H_2S in presence of NH_4OH this is group reagent for **IV** group basic radical hence $\boxed{Mn^{2+}}$

Q → $(NH_4)_2CO_3$ in presence of NH_4OH is group reagent for **V** group basic radical. hence $\boxed{Ba^{2+}}$

R → NH_4OH in presence of NH_4Cl is group reagent of **III** group basic radical hence $\boxed{Al^{3+}}$

S → passing H_2S in presence of dil HCl is group reagent of **II** group hence $\boxed{Cu^{2+}}$

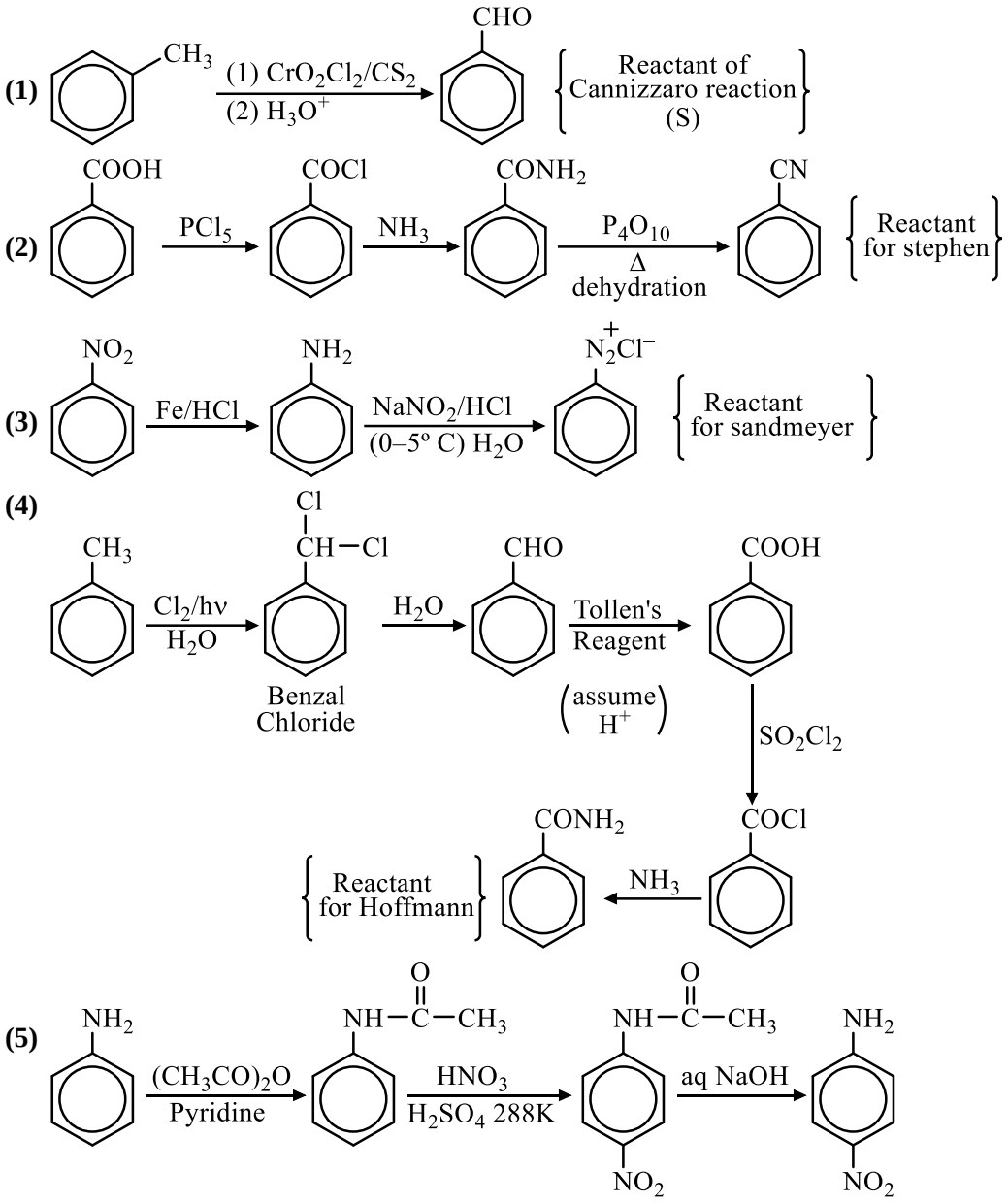
15. The major products obtained from the reactions in List-II are the reactants for the named reactions mentioned in List-I. Match each entry in List-I with the appropriate entry in List-II and choose the correct option.

List-I	**List-II**
(P) Stephen reaction	(1) Toluene $\xrightarrow[(ii)\,H_3O^+]{(i)\,CrO_2Cl_2/CS_2}$
(Q) Sandmeyer reaction	(2) Benzoic acid $\xrightarrow[(ii)\,NH_3]{(i)\,PCl_5}$ $\xrightarrow{(iii)\,P_4O_{10},\Delta}$
(R) Hoffmann bromamide degradation reaction	(3) Nitrobenzene $\xrightarrow[(ii)\,HCl,\,NaNO_2]{(i)\,Fe,HCl}$ $\xrightarrow{(273-278K),H_2O}$
(S) Cannizzaro reaction	(4) Toluene $\xrightarrow[(ii)\,Tollen's\ reagent]{(i)\,Cl_2/hv,H_2O}$ $\xrightarrow[(iv)\,NH_3]{(iii)\,SO_2Cl_2}$
	(5) Aniline $\xrightarrow[(ii)\,HNO_3,H_2SO_4,\,288K]{(i)\,(CH_3CO)_2O,Pyridine}$ $\xrightarrow{(iii)\,aq.NaOH}$

(A) P → 2; Q → 4; R → 1; S → 3
(B) P → 2; Q → 3; R → 4; S → 1
(C) P → 5; Q → 3; R → 4; S → 2
(D) P → 5; Q → 4; R → 2; S → 1

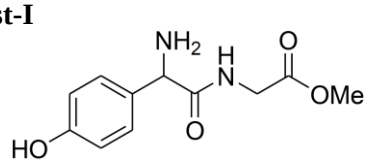
Sol. **B**

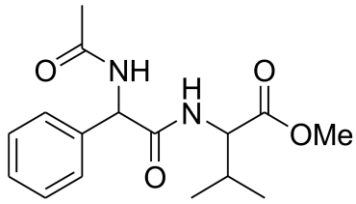
Etard Reaction

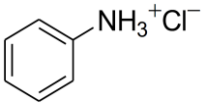


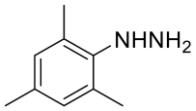
16. Match the compounds in List-I with the appropriate observations in List-II and choose the correct option.

List-I

(P) 

(Q) 

(R) 

(S) 

List-II

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

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

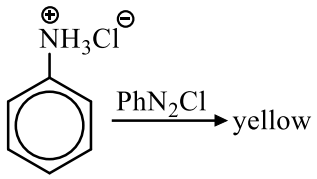
(3) Reaction with glucose will give corresponding hydrazone.

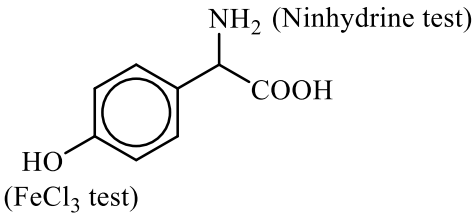
(4) Lassiagne extract of the compound treated with dilute HCl followed by addition of aqueous $FeCl_3$ gives blood red color.

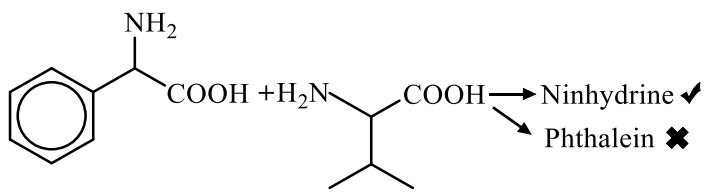
(5) After complete hydrolysis, it will give ninhydrin test and it DOES NOT give positive phthalein dye test.

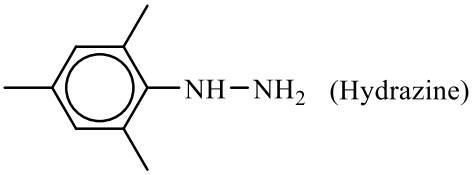
(A) P → 1; Q → 5; R → 4; S → 2
(B) P → 2; Q → 5; R → 1; S → 3
(C) P → 5; Q → 2; R → 1; S → 4
(D) P → 2; Q → 1; R → 5; S → 3

Sol. **B**

(R) 

(P) 



(S) 

Mr.Nitin Viijay (NV SIR)

मोशन है तो भरोसा है

	Physics				Chemistry		Math
Name	Chandra S. Sharma	Ankush Jain	Amit Kumar Singh	Amit Kumar Rathore	Sharad Kothari	Sanjay Sodhani	Shubham Soni
Kota Exp.	(CSS Sir)	(AKJ Sir)	(AKS Sir)	(AR Sir)	(SK Sir)	(Sodhani Sir)	(SBS Sir)
Rank Under 100	20 yrs.	15 yrs.	16 yrs.	16 yrs.	18 yrs.	16 yrs.	12 yrs.
Selection in IIT	AIR-2,4,5 (65+)	AIR-4,5 (5)	(10)	AIR-1 (5)	AIR-1 (12)	AIR-1 (16)	NA
Selection in NIT	11000+	8000+	2500+	2500+	10000+	10000+	200+
(Approx)	25000+	15000+	12000+	12000+	18000+	17000+	1000+

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Rohit Malav (RM Sir) Sr. Faculty Exp. : 13
Sanjay Gandhi (SG Sir) Sr. Faculty Exp. : 17

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Nikhil Srivastava (NS sir) Deputy Director Exp. : 22
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Atish Agarwal (AA sir) Sr. Faculty (VP-Outside Centres) Exp. : 22
Jayant Chittora (JC sir) Sr. Faculty Exp. : 21
Arjun Gupta (Arjun sir) Sr. Faculty Exp. : 18
Vipin Sharma (VS sir) Sr. Faculty Exp. : 13

Deepak Singh (DPS Sir) Sr. Faculty Exp. : 19
Krishan Kumar Soan (KKS Sir) Sr. Faculty Exp. : 19
Indrajeet Chourasiya (IC Sir) Sr. Faculty Exp. : 16
Ashutosh Vishvkarma (Ashutosh Sir) Faculty Exp. : 6
Anirudha Yadav (ANY Sir) Faculty Exp. : 5

PHYSICAL CHEMISTRY

Ram Ratan Dwivedi (RRD sir) Sr. Faculty & Joint Director Exp. : 24
Akhilesh Kanther (AKK sir) Sr. Faculty Exp. : 22
Jitendra Hirwani (JH Sir) Sr. Faculty Exp. : 20
Deepak Sharma (DS Sir) Sr. Faculty Exp. : 13

Shravan Choudhary (SC Sir) Sr. Faculty Exp. : 9
Shaleen Singhwal (Shaleen Sir) Faculty Exp. : 7
Mukesh Suman (MSS Sir) Faculty Exp. : 14

INORGANIC CHEMISTRY

Vishal Joshi (VJ sir) Sr. Faculty Exp. : 23
Dr. Deepak Joshi (DJ Sir) Sr. Faculty Exp. : 30
Devki Nandan (DN sir) Sr. Faculty Exp. : 22

Ritesh Kumar (RTK Sir) Sr. Faculty Exp. : 14
Amit Singh Sisodiya (AMS Sir) Faculty Exp. : 12

ORGANIC CHEMISTRY

Surendra K. Mishra (SKM sir) Sr. Faculty Exp. : 24
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