JEE Main January 2026

Question Paper With Text Solution

23 January | Shift-1

CHEMISTRY

MATRIX

JEE Main & Advanced | XI-XII Foundation| VI-X Pre-Foundation

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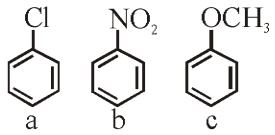
JEE MAIN JANUARY 2026 | 23 JANUARY SHIFT-1

SECTION – A

Question ID : 8606541414

51. Consider the following compounds



Arrange these compounds in the increasing order of reactivity with nitrating mixture.

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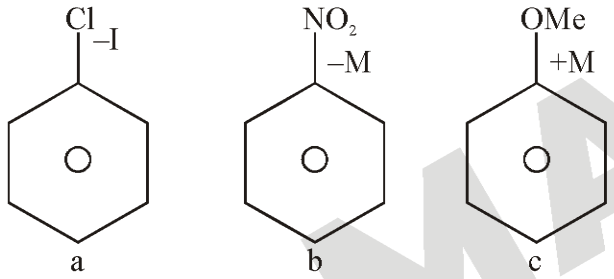
(1) c < b < a (2) b < c < a (3) c < a < b (4) b < a < c

Ans. Official answer NTA (4)

Sol.



Order of electron density of benzene ring : c > a > b

Hence, order of reactivity with nitrating mixture :

b < a < c

Question ID : 8606541405

52. Which one of the following graphs accurately sepresents the plot of partial pressure of CS_2 vs its mole fraction in a mixture of acetone and CS_2 at constant temperature ?

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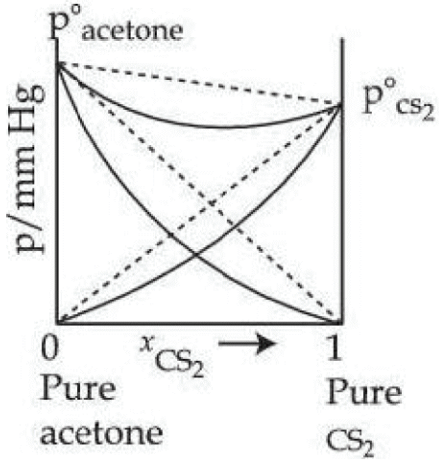
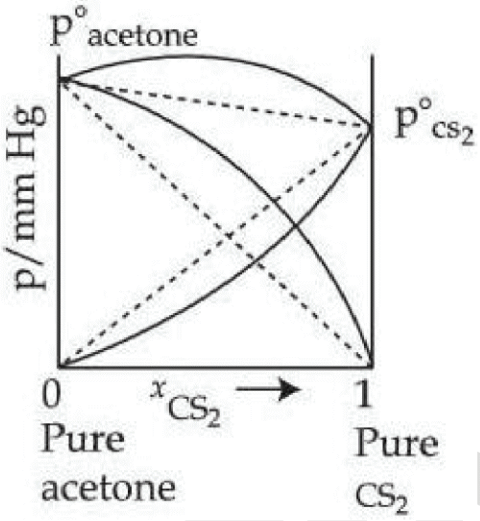
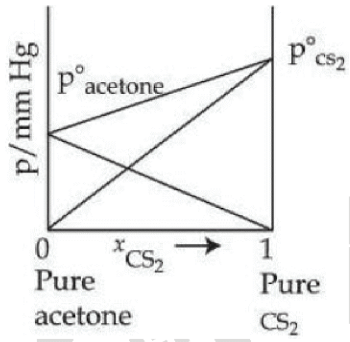
(1)



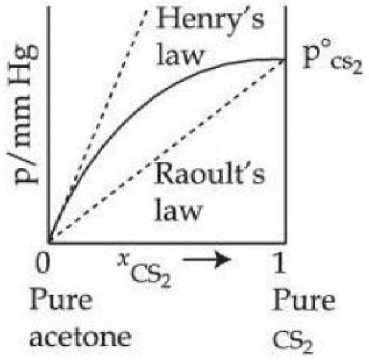
(2)



(3)



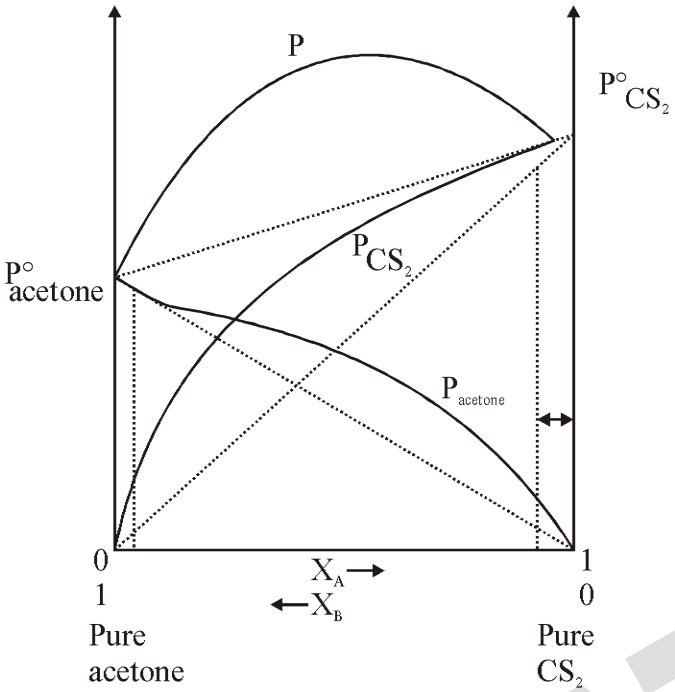
(4)



Ans. Official answer NTA (4)

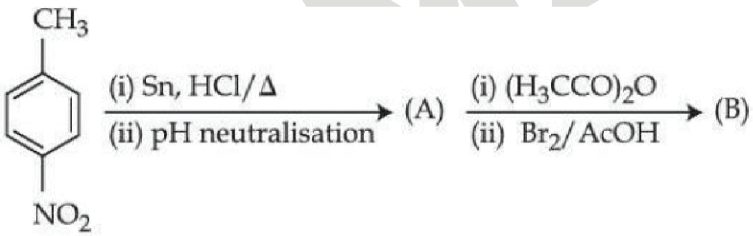
Sol. The mixture of acetane and CS_2 shows positive deviation from Raoult's law

So, graph 4 is correct



Question ID : 8606541419

53. Consider the following sequence of reactions.



4-Nitrotoluene

Assuming that the reaction proceeds to completion, then 137 mg of 4–nitrotoluene will produce _____ mg of B.

(Given molar mass in g mol^{-1} H : 1, C : 12, N : 14, O : 16, Br : 80)

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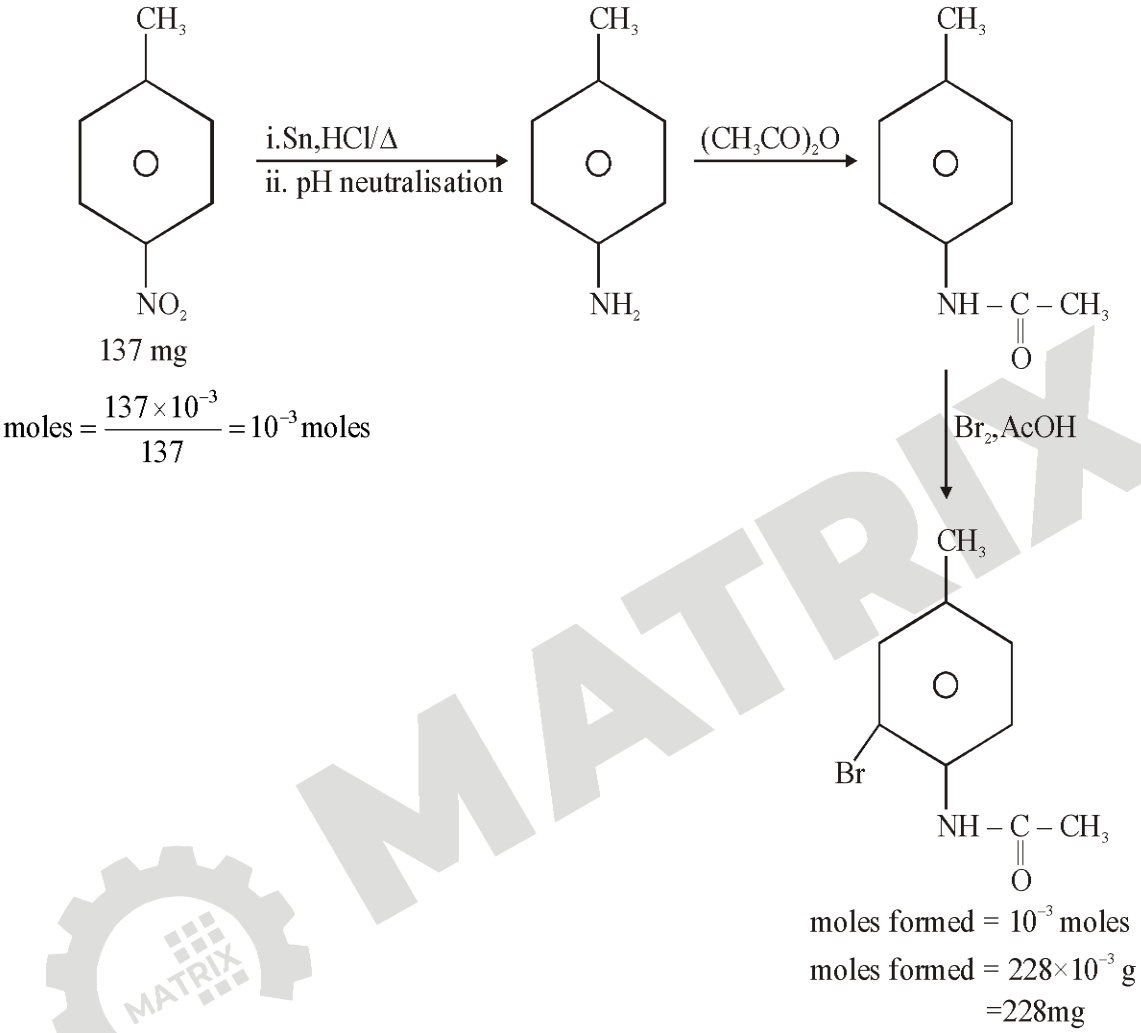
(1) 301 (2) 146 (3) 228 (4) 208

Ans. Official answer NTA (3)

Sol. The reaction involved is :



137 mg

$$\text{moles} = \frac{137 \times 10^{-3}}{137} = 10^{-3} \text{ moles}$$

moles formed = 10^{-3} moles

moles formed = 228×10^{-3} g

=228mg

Question ID : 8606541408

54. The correct trend in the first ionization enthalpies of the elements in the 3rd period of periodic table is :

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(1) S < Si < Al < P < Cl

(2) Al < Si < S < P < Cl

(3) Al < S < P < Si < Cl

(4) Si < S < Al < P < Cl

Ans. Official answer NTA (2)

Sol. The correct order of first ionisation enthalpy for 3rd period element :

Cl > P > S > Si > Al

Question ID : 8606541417

55. 'x' is the product which is obtained from propanenitrile and stannous chloride in the presence of hydrochloric acid followed by hydrolysis. 'y' is the product which is obtained from the but–2–ene by the ozonolysis followed hydrolysis. From the following, which product is not obtained when one mole of 'x' and one mole of 'y' react with each other in the presence of alkali followed by heating ?

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(1) 3–Methylbut–2–enal (2) 2–Methylbut–2–enal

(3) Pent–2–enal (4) 2–Methylpent–2–enal

Ans. Official answer NTA (1)

Sol.

$$CH_3 - CH_2 - CN + SnCl_2 \xrightarrow[H_2O]{HCl} CH_3 - CH_2 - \overset{\overset{O}{\|}}{C} - H$$

$$CH_3 - CH = CH - CH_3 \xrightarrow[H_2O]{O_3} CH_3 - CHO$$

$$CH_2 - CH_2 - \overset{\overset{O}{\|}}{C} - H + CH_3 - CHO$$

$\downarrow$ $^-OH, \Delta$

$$CH_3 - CH = CHO + CH_3 - CH = C - CHO$$

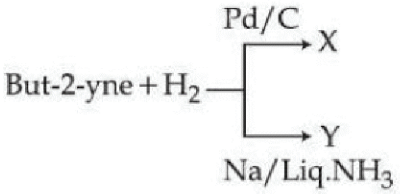
But–2–enal 2–Methylbut–2–enal

$$CH_3 - CH_2 - CH = CH - CHO + CH_3 - CH_2 - CH = \overset{\overset{CH_3}{|}}{C} - CHO$$

Pent–2–enal 2–methylpent–2–enal

Question ID : 8606541415

56. But–2–yne and hydrogen (one mole each) are separately treated with (i) Pd/C and (ii) Na/liq. NH_3 to give the products X and Y respectively.



Identify the incorrect statements :

A. X and Y are stereoisomers.

B. Dipole moment of X is zero.

C. Boiling point of X is higher than Y.

D. X and Y react with $O_3/Zn + H_2O$ to give different products.

Choose the correct answer from the options given below :

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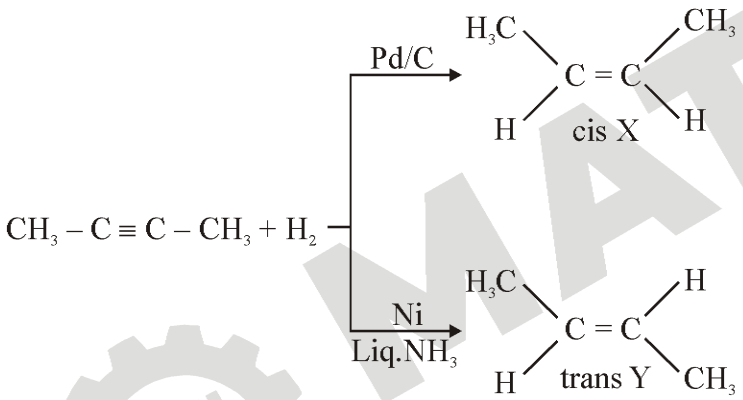
(1) B and C only (2) A and C only

(3) A and B only (4) B and D only

Ans. Official answer NTA (4)

Sol.



→ X and Y are stereoisomers

→ X is polar, so dipole moment is non-zero.

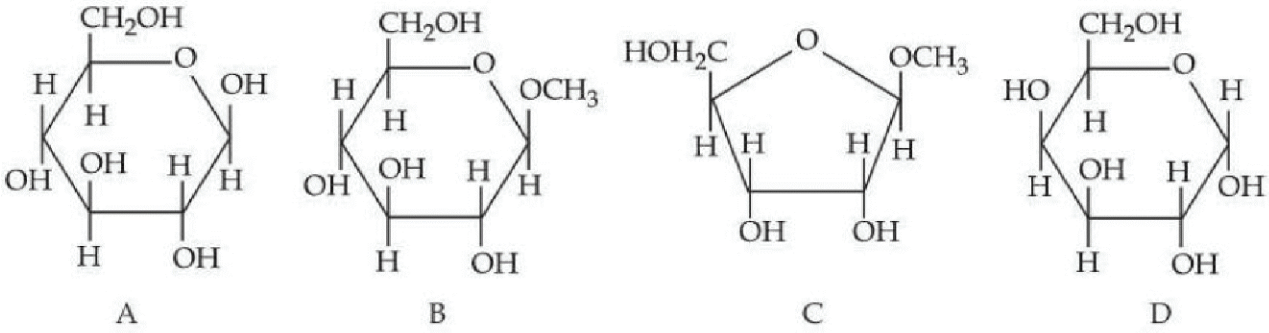
→ Boiling point of X is higher than Y.

→ Both X and Y with $O_3/Zn + H_2O$ give same products.

$$But-2-ene\,(cis/trans) \xrightarrow[ii.H_2O]{i.O3/Zn} 2CH_3CHO$$

Question ID : 8606541420

57. From the given following (A to D) cyclic structures, those which will not react with Tollen's reagent are :



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(1) A and D (2) A and B (3) B and C (4) B and D

Ans. Official answer NTA (3)

Sol. Non-reducing sugar does not react with Tollen's reagent.

Compounds B and C are acetals. So, do not react with Tollen's reagent.

Question ID : 8606541413

58. Given below are two statements :

Statement I : Sublimation is used for the separation and purification of compounds with low melting point.

Statement II : The boiling point of a liquid increases as the external pressure is reduced.

In the light of the above statements, choose the correct answer from the options given below :

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(1) Statement I is false but statement II is true.

(2) Both statement I and Statement II are true.

(3) Both statement I and statement II are false.

(4) Statement I is true but statement II is false.

Ans. Official answer NTA (3)

Sol. **Statement-I :** False

Sublimation separates those solids among which one can directly change to gas on heating.

Statement-II : False

On decreasing external pressure, the vapour pressure required to boil a substance is achieved at low temperature. So, boiling point decreases.

Question ID : 8606541412

59. Match List-I with List-II.

List-I	**List-II**
Functional group (detection)	**Change observed during detection**
A. Unsaturation (Baeyer's test)	I. Red colour appears
B. Alcoholic group (Ceric ammonium nitrate test)	II. Silver mirror appears
C. Aldehyde group (Tollen's reagent)	III. Violet colour appears
D. Phenolic group ($FeCl_3$ test)	IV. Discharge of pink colour

Choose the correct answer from the options given below :

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(1) A–III, B–IV, C–II, D–I (2) A–III, B–IV, C–I, D–II

(3) A–IV, B–I, C–II, D–III (4) A–IV, B–III, C–II, D–I

Ans. Official answer NTA (3)

Sol. A. Baeyer's reagent changes from pink to brown.

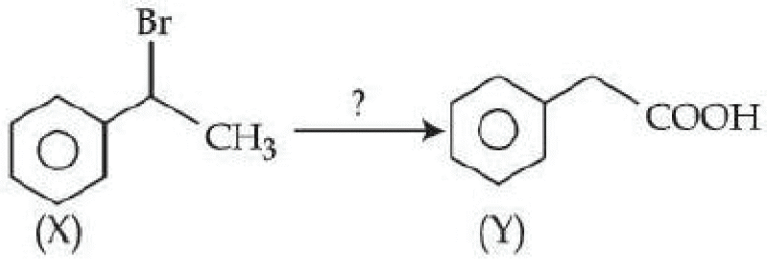
B. Ceric ammonium nitrate give red colour with alcohol.

C. Tollen's reagent form silver mirror with aldehyde.

D. $FeCl_3$ gives violet colour with phenolic group.

Question ID : 8606541416

60.



The correct sequence of reagents for the above conversion of X to Y is :

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(1) (i) Jones reagent (ii) NaOEt (iii) Hot $KMnO_4$/KOH

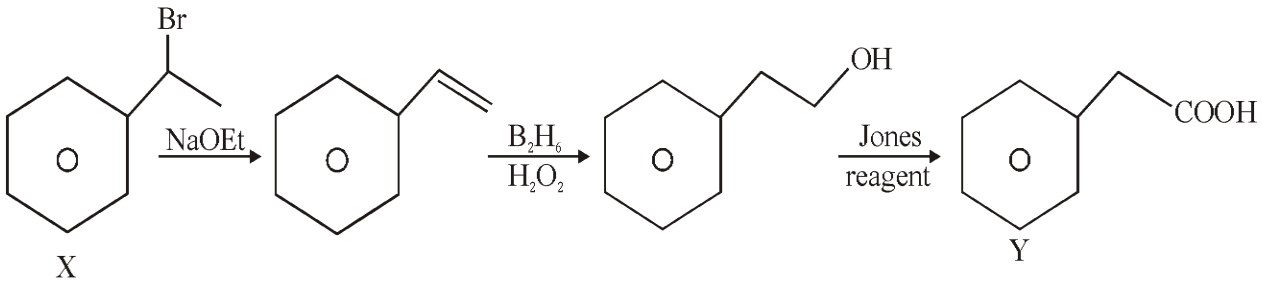
(2) (i) NaOH (aq) (ii) Jones reagent (iii) H_3O^+

(3) (i) B_2H_6/H_2O_2 (ii) NaOEt (iii) Jones reagent

(4) (i) NaOEt (ii) B_2H_6/H_2O_2 (iii) Jones reagent

Ans. Official answer NTA (4)

Sol.



Question ID : 8606541410

61. Given below are two statements :

Statement I : $[CoBr_4]^{2-}$ ion will absorb light of lower energy than $[CoCl_4]^{2-}$ ion.

Statement II : In $[CoI_4]^{2-}$ ion, the energy separation between the two set of d–orbitals is more than $[CoCl_4]^{2-}$ ion.

In the light of the above statements, choose the correct answer from the options given below :

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(1) Both statement I and statement II are false.

(2) Statement I is false but statement II is true.

(3) Statement I is true but statement II is false.

(4) Both statement I and statement II are true.

Ans. Official answer NTA (3)

Sol. Strength of ligands :

$Cl^- > Br^- > I^-$

Order of splitting :

$[CoCl_4]^{2-} > [CoBr_4]^{2-} > [CoI_4]^{2-}$

So, order of energy obsorbed :

$[CoCl_4]^{2-} > [CoBr_4]^{2-} > [CoI_4]^{2-}$

Question ID : 8606541409

62. The correct statements from the following are :

A. Ionic radii of trivalent cations of group 13 elements decreases down the group.

B. Electronegativity of group 13 element decreases down the group.

C. Among the group 13 elements, Boron has highest first ionisation enthalpy.

D. The trichloride and triiodide of group 13 elements are covalent in nature.

Choose the correct answer from the options given below :

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(1) A and D only
(2) B and D only
(3) C and D only
(4) A and C only

Ans. Official answer NTA (3)

Sol. A. The ionic radii of trivalent cations of group – 13 element increases down the group.

B. Electronegativity of group 13 does not give regular trend down the group. EN : B > Tl > In > Ga > Al

C. Among group 13 elements, boron has highest first IE.

D. The trichloride and triiodide of group – 13 elements are covalent in nature.

Question ID : 8606541407

63. In the given electrochemical cell, Ag(s) | AgCl(s) | $FeCl_2$ (aq), $FeCl_3$(aq)| Pt(s) at 298 K, the cell potential (E_{cell}) will increase when :

A. Concentration of Fe^{2+} is increased.

B. Concentration of Fe^{3+} is decreased.

C. Concentration of Fe^{2+} is decreased.

D. Concentration of Fe^{3+} is increased.

E. Concentration of Cl^- is increased.

Choose the correct answer from the options given below :

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(1) B only
(2) A and B only
(3) A and E only
(4) C, D and E only

Ans. Official answer NTA (4)

Sol. Anode :– $Cl^- + Ag \rightarrow AgCl + e^-$

Cathode :– $Fe^{3+} + e^- \rightarrow Fe^{2+}$

$Cl^- + Fe^{3+} + Ag \rightarrow AgCl + Fe^{2+}$

$$E_{cell} = E^\circ_{cell} - 0.0591 \log \frac{[Fe^{2+}]}{[Fe^{3+}][Cl^-]}$$

$$E_{cell} = E^\circ_{cell} + 0.0591 \log \frac{[Fe^{3+}][Cl^-]}{[Fe^{2+}]}$$

So, E_{cell} increases when concentration of :

i. Fe^{3+} is increases

ii. Fe^{2+} is decreased

iii. Cl^- is increased

Question ID : 8606541404

64. A cup of water at 5°C (system) is placed in a microwave oven and the oven is turned on for one minute during which the water begins to boil. Which of the following option is true ?

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(1) q = –ve, w = –ve, ΔU = –ve
(2) q = +ve, w = –ve, ΔU = +ve
(3) q = +ve, w = –ve, ΔU = +ve
(4) q = +ve, w = 0, ΔU = –ve

Ans. Official answer NTA (3)

Sol. When the oven is turned on then heat is given, So q = Positive
Work is done by system, w = negative
And internal energy of gas is more than liquid, so ΔU = positive

Question ID : 8606541406

65. Consider the general reaction given below at 400 K.

$$xA(g) \rightleftharpoons yB(g)$$

The values of K_p and K_c are studied under the same condition of temperature but variation in x and y.

(i) $K_p = 85.87$ and $K_c = 2.586$ appropriate units

(ii) $K_p = 0.862$ and $K_c = 28.62$ appropriate units

The values of x and y in (i) and (ii) respectively are :

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	(i)	(ii)
(1)	1,3	2,1
(2)	3,1	3,1
(3)	4,1	4,1
(4)	1,2	2,1

Ans. Official answer NTA (4)

Sol. As $K_P = K_C(RT)^{\Delta ng}$

for $xA(g) \rightleftharpoons yB(g)$ $\Delta ng = y - x$

for reaction (i) : $K_P > K_C$

$85.87 = 2.586\ (RT)^{y-x}$

$85.87 = 2.586\ (0.0821 \times 400)^{y-x}$

On solving ; $y - x \approx 1$

Possible values : x = 1, y = 2

for reaction (ii) : $K_P < K_C$

$0.862 = 28.62\ (0.0821 \times 400)^{y-x}$

On solving, $y - x \approx -1$

Possible values : x = 2, y = 1

Question ID : 8606541402

66. Given,

(A) $n = 5, m_l = -1$

(B) $n = 3, l = 2, m_l = -1, m_s = +\frac{1}{2}$

The maximum number of electron(s) in an atom that can have the quantum numbers as given in (A) and (B) respectively are :

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(1) 4 and 1 (2) 8 and 1 (3) 2 and 4 (4) 26 and 1

Ans. Official answer NTA (2)

Sol. A $\Rightarrow$ n = 5, $m_l = -1$

Possible orbitals : 5p, 5d, 5f, 5g

Electrons : 2 2 2 2

Maximum electrons = 8

B. n = 3, l = 2, $m_l = -1$, ms = +1/2

For given combination, only 1 electron

Question ID : 8606541401

67. Which of the following statements regarding the energy of the stationary state is true in the following one-electron systems?

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(1) $+8.72 \times 10^{-18}\ J$ for first orbit of He^+ ion

(2) $-2.18 \times 10^{-18}\ J$ or third orbit of Li^{2+} ion

(3) $+2.18 \times 10^{-18}\ J$ for second orbit of He^+ ion

(4) $-1.09 \times 10^{-18}\ J$ for second orbit of H atom.

Ans. Official answer NTA (2)

Sol. $E = -13.6 \times \frac{Z^2}{n^2} eV$

or $E = -13.6 \times 1.6 \times 10^{-19} \frac{Z^2}{n^2} J$

A. n = 1 for He^+ z = 2

$E = -13.6 \times 1.6 \times 10^{-19} \times \frac{4}{1} = -8.704 \times 10^{-18}$ J

B. Li^{2+} ion Z = 3, n = 3

$E = -13.6 \times 1.6 \times 10^{-19} \times \frac{9}{9} = -2.18 \times 10^{-18}$ J

C. He^{+}, Z = 2, n = 2

$E = -2.18 \times 10^{-18}$ J

D. H-atom, Z = 1, n = 2

$E = -13.6 \times 1.6 \times 10^{-19} \times \frac{1}{4} = -5.44 \times 10^{-19}$ J

Question ID : 8606541411

68. The statements that are incorrect about the nickel(II) complex of dimethylglyoxime are :

A. It is red in colour.

B. It has a high solubility in water at pH = 9.

C. The Ni ion has two unpaired d-electrons.

D. The N – Ni – N bond angle is almost close to 90°.

E. The complex contains four five-membered metallacycles (metal containing rings).

Choose the correct answer from the options given below :

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(1) B, C and E Only (2) C and E Only (3) C and D Only (4) A, D and B Only

Ans. Official answer NTA (1)

Sol. $Ni^{2+} + dmg^{-1} \rightarrow [Ni(dmg)_2]$ Rosy red

A

→ Insoluble of H_2O

→ N – Ni – N bond is almost close to 90°.

→ Contains 2 five-membered metallacycles.

→ Ni^{2+} ion has no unpaired d-electrons.

Question ID : 8606541403

69. Identify the molecule (X) with maximum number of lone pairs of electrons (obtained using Lewis dot structure) among HNO_3, H_2SO_4, NF_3 and O_3. Choose the correct bond angle made by the central atom of the molecule (X).

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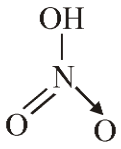
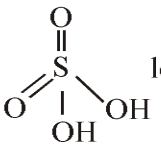
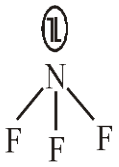
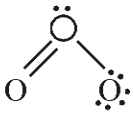
(1) 102° (2) 120° (3) 116° (4) 107°

Ans. Official answer NTA (1)

Sol. $HNO_3 \rightarrow$  lone pairs = 7

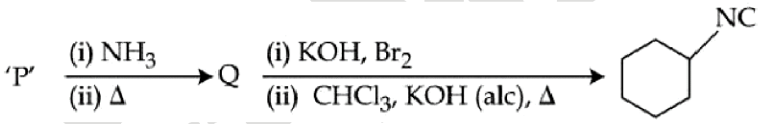
$H_2SO_4 \rightarrow$  lone pairs = 8

$NF_3 \Rightarrow$  lone pairs = 101° ⟶ Bond angle = 102°

O_3  lone pairs = 6

Question ID : 8606541418

70. Compound ' P ' undergoes the following sequence of reactions :



'P' is

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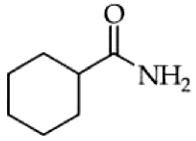
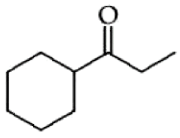
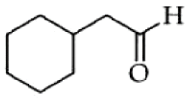
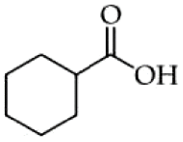
(1) 

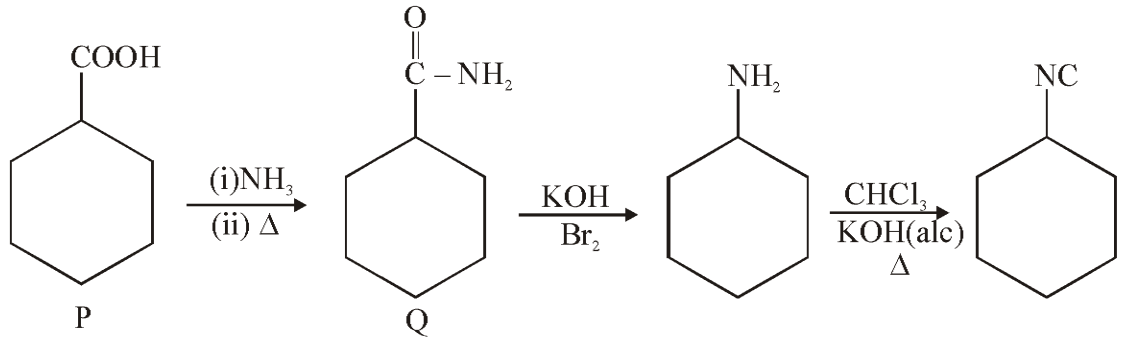
(2) 

(3) 

(4) 

Ans. Official answer NTA (4)

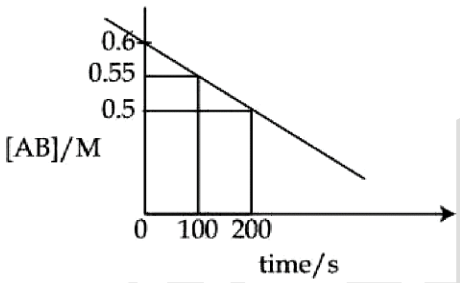
Sol.



SECTION – B

Question ID : 8606541423

71. For the thermal decomposition of reactant AB(g), the following plot is constructed.



The half life of the reaction is 'x' min.

x = _____ min. (Nearest integer)

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Ans. Official answer NTA (10)

Sol. The plot represents zero - order reaction :

$[AB]_t = [AB]_0 - kt$

$$\text{Slope} = -k = \frac{y_2 - y_1}{x_2 - x_1} = \frac{0.5 - 0.55}{200 - 100} = -\frac{0.05}{100}$$

$k = 5 \times 10^{-4}$

$$\text{Half life } t_{\frac{1}{2}} = \frac{[AB]_0}{2k} = \frac{0.6}{2 \times 5 \times 10^{-4}} = \frac{0.6}{10^{-3}} = 600\,\text{sec} = 10\,\text{min}$$

x = 10

Question ID : 8606541425

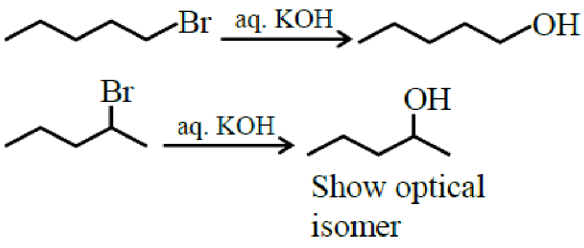
72. Consider all the structural isomers with molecular formula $C_5H_{11}Br$ are separately treated with KOH(aq) to give respective substitution products, without any rearrangement. The number of products which can exhibit optical isomerism from these is_____.

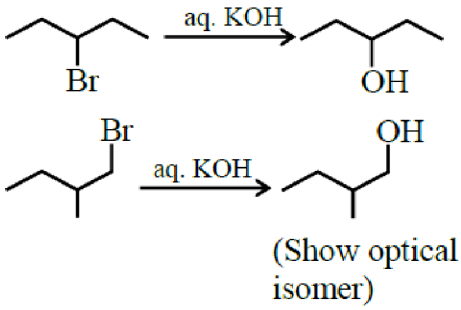
Ans. Official answer NTA (3)

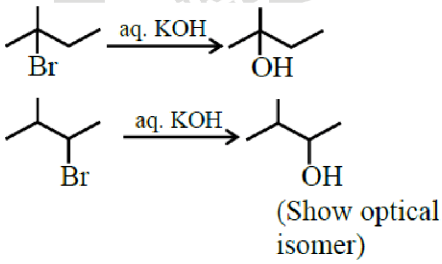
Answer by MATRIX (3 or 6)

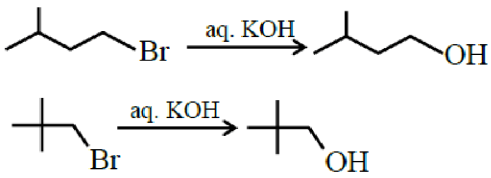
Sol. $C_5H_{11}Br$ DoU = 0

$C_5H_{11}Br$









According to language of question the total number of products which can exhibit optical isomerism should be 6 because each optically active product will have its another optically active enantiomer .

Correct answer should be 6 .

Question ID : 8606541422

73. For the following gas phase equilibrium reaction at constant temperature,

$NH_3(g) = 1/2\,N_2(g) + 3/2\,H_2(g)$

if the total pressure is $\sqrt{3}$ atm and the pressure equilibrium constant (K_p) is 9 atm , then the degree of dissociation is given as $(x \times 10^{-2})^{-1/2}$. The value of x is _____ (nearest integer)

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Ans. Official answer NTA (125)

Sol. $NH_3(g) \rightleftharpoons \frac{1}{2}N_2(g) + \frac{3}{2}H_2(g)$

t = 0 1 mole

t = teq $1-\alpha$ $\frac{\alpha}{2}$ $\frac{3\alpha}{2}$ $P_T = \sqrt{3}$ atm

$n_T = 1 - \alpha + \frac{\alpha}{2} + \frac{3\alpha}{2}$

$= 1 + \alpha$

$k_P \frac{\left(\frac{\alpha}{2}\right)^{\frac{1}{2}}\left(\frac{3\alpha}{2}\right)^{\frac{3}{2}}}{1-\alpha}\left(\frac{P_T}{n_T}\right)^1$

$9 = \frac{\left(\frac{\alpha}{2}\right)^{\frac{1}{2}}\left(\frac{3\alpha}{2}\right)^{\frac{3}{2}}}{1-\alpha}\left[\frac{(3)^{\frac{1}{2}}}{1+\alpha}\right] = \frac{9\left(\frac{\alpha}{2}\right)^2}{1-\alpha^2}$

$1-\alpha^2 = \frac{\alpha^2}{4}$

$\alpha^2 = 0.8$

$\alpha = (0.8)^{\frac{1}{2}} = \left(\frac{1}{0.8}\right)^{\frac{-1}{2}} = \left(125 \times 10^{-2}\right)^{-\frac{1}{2}}$

x = 125

Question ID : 8606541424

74. The crystal field splitting energy of $[Co(oxalate)_3]^{3-}$ complex is 'n' times that of the $[Cr(oxalate)_3]^{-3}$ complex. Here 'n' is_____. (Assume $\Delta_0 >> P$)

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Ans. Official answer NTA (2)

Sol. $[Co(oxalate)_3]^{3-} : Co^{3+} \rightarrow t_{2g}^6 eg^\circ$, CFSE = $-2.4\Delta_0$

$[Cr(oxalate)_3]^{3-} : Cr^{3+}\ t_{2g}^3 eg^\circ$; CFSE = $-1.2\ \Delta_0$

CFSE of $[Co(oxalate)_3]^{3-}$ is 2 times the CFSE of $[Cr(oxalate)]^{3-}$

Question ID : 8606541421

75. x of pure HCl was used to make an aqueous solution. 25.0 mL of 0.1 M $Ba(OH)_2$ solution is used when the HCl solution was titrated against it. The numerical value of x is ____ $\times 10^{-1}$. (Nearest integer)

Given : Molar mass of HCl and $Ba(OH)_2$ are 36.5 and 171.0 g mol^{-1} respectively.

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Ans. Official answer NTA (1825)

Sol. $2HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2H_2O$

0.1 M

25.0 mL

moles of $Ba(OH)_2 = 0.1 \times 25 = 2.5$ m moles

1 mole of $Ba(OH)_2$ reacts with = 2 moles of HCl

2.5 m moles of $Ba(OH)_2$ reacts with = $2 \times 2.5 = 5$ m moles of HCl

Mass of HCl = $5 \times 10^{-3} \times 36.5$

= 182.5×10^{-3} g

x = 182.5 mg

x = 1825×10^{-1} mg.