JEE Main January 2023

Question Paper With Text Solution

31 January | Shift-1

CHEMISTRY

MATRIX

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

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1. The correct order of basicity of oxides of vanadium is

(1) $V_2O_3 > V_2O_4 > V_2O_5$ (2) $V_2O_4 > V_2O_3 > V_2O_5$

(3) $V_2O_3 > V_2O_5 > V_2O_4$ (4) $V_2O_5 > V_2O_4 > V_2O_3$

वैनेडियम के ऑक्साइडों की क्षारकता का सही क्रम है–

(1) $V_2O_3 > V_2O_4 > V_2O_5$ (2) $V_2O_4 > V_2O_3 > V_2O_5$

(3) $V_2O_3 > V_2O_5 > V_2O_4$ (4) $V_2O_5 > V_2O_4 > V_2O_3$

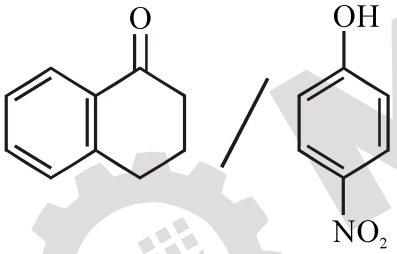
Question ID: 366694579

Ans. Official Answer NTA (1)

Sol. $V_2O_3 > V_2O_4 > V_2O_5$

As positive oxidation state increases acidic nature increases and basic nature decreases.

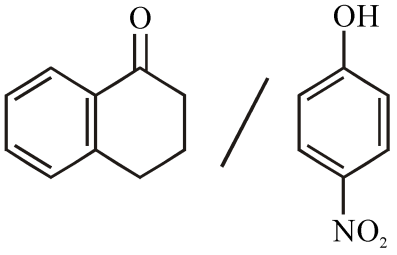
2. Match items of column-I and column-II

Column-I (Mixture of compounds)	**Column-II (Separatin Technique)**
a. H_2O/CH_2Cl_2	i. Crystallization
b. 	ii. Differential solvent extraction
c. Kerosene/naphthalene	iii. Column chromatography
d. $C_6H_{12}O_6$/NaCl	iv. Fractional Distillation

Correct match is

(1) a-iii, b-iv, c-ii, d-i (2) a-ii, b-iii, c-iv, d-i (3) a-i, b-iii, c-ii, d-iv (4) a-ii, b-iv, c-i, d-iii

सूची I तथा सूची II के मदों का मिलान कीजिए

सूची-I (यौगिक मिश्रण)	**सूची-II (पृथक्करण तकनीक)**
a. H_2O/CH_2Cl_2	i. क्रिस्टलन
b. 	ii. विभेदी (विलायक) निष्कर्षण
c. किरोसिन/नैफ्थेलीन	iii. कॉलम क्रोमेटोग्राफी

d. $C_6H_{12}O_6$/NaCl iv. प्रभाजी आसवन

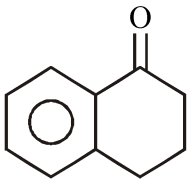
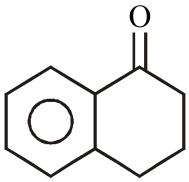
सही मिलान है

(1) a-iii, b-iv, c-ii, d-i (2) a-ii, b-iii, c-iv, d-i (3) a-i, b-iii, c-ii, d-iv (4) a-ii, b-iv, c-i, d-iii

Question ID: 366694582

Ans. Official Answer NTA (2)

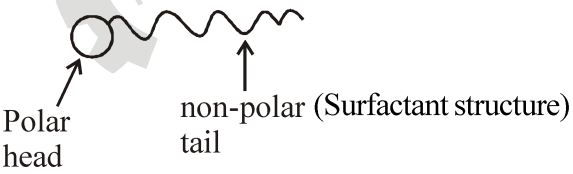
Sol. A. $H_2O/CH_2Cl_2 \rightarrow$ ii, $CH_2Cl_2 > H_2O$ (density) so they can be separated by differential solvent extraction.

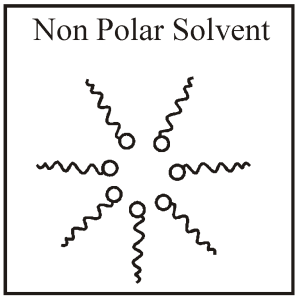
B.   iii. column chromatography Due to H-bonding  in it can be separated from  by column chromatography.

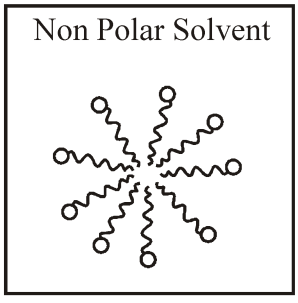
C. Kerosene / Naphthalene $\rightarrow$ iv. Fractional distillation. Due to different B.P. of kerosene and Naphthalene it can be separated by fractional distillation.

D. $C_6H_{12}O_6$/NaCl $\rightarrow$ i. Crystallization. NaCl (ionic compound) can be crystallized.

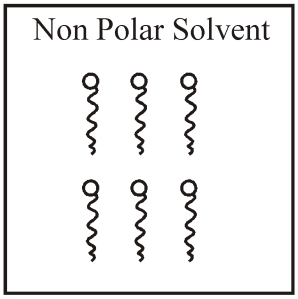
3. Adding surfactants in non polar solvent, the micelles structure will look like



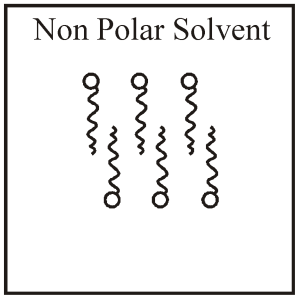
(a) 

(b) 

(c)

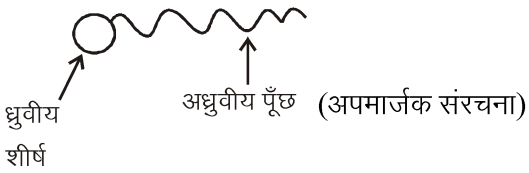


(d)

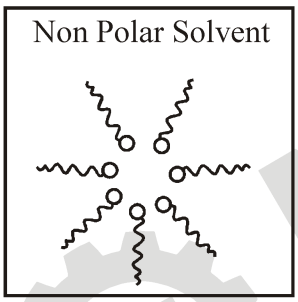


(1) d (2) c (3) b (4) a

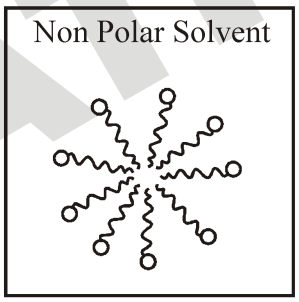
अपमार्जक को अध्रुवीय विलायक में मिलाने पर मिसेल की संरचना निम्नलिखित में से किस प्रकार की दिखेगी?



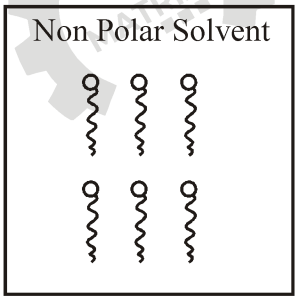
(a)



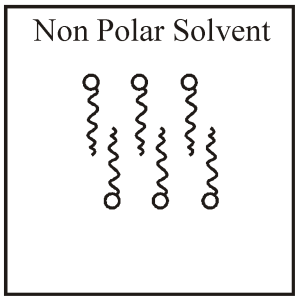
(b)



(c)



(d)

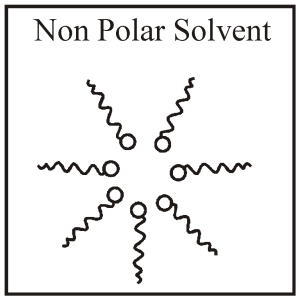


(1) d (2) c (3) b (4) a

Question ID: 366694573

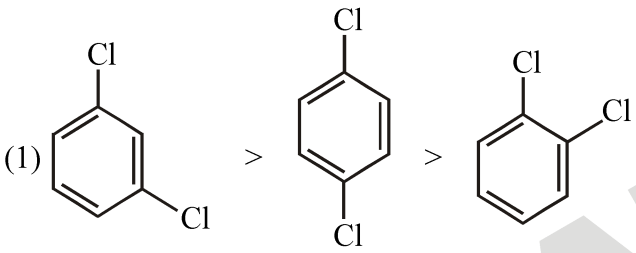
Ans. Official Answer NTA (4)

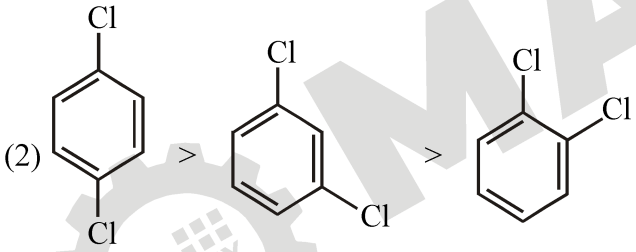
Sol. When surfactant added in polar solvent following micelles structure is obtained.

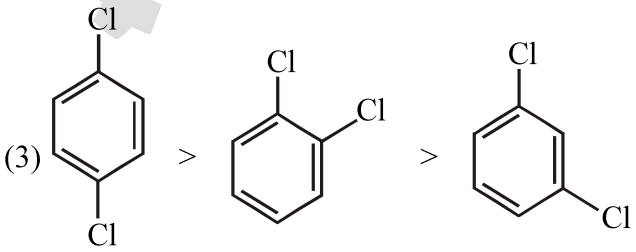


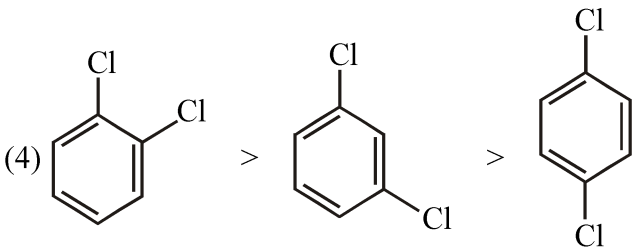
Non-polar tails will be towards non–polar solvent.

4. The correct order of melting points of dichlorobenzenes is

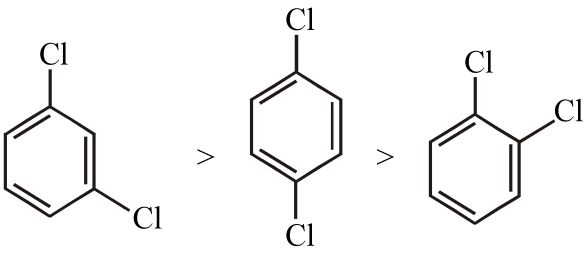
(1) 

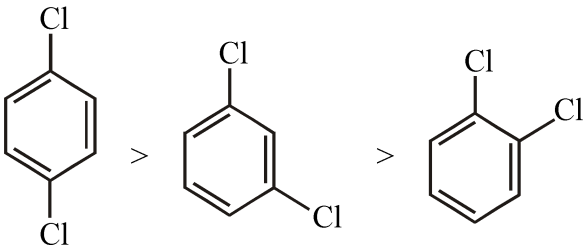
(2) 

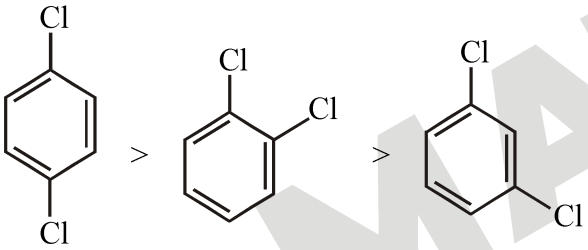
(3) 

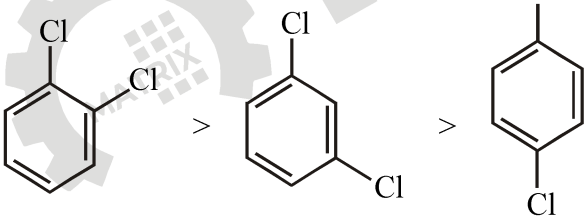
(4) 

डाइक्लोरोबेन्जीनों के लिए गलनांक का सही क्रम है :

(1)  > >

(2)  > >

(3)  > >

(4)  > >

Question ID: 366694584

Ans. Official Answer NTA (3)

Sol. Out of o, m, p-dichlorobenzene para isomer has maximum melting point due to symmetrical nature.

5. The methods NOT involved in concentration of ore are

a. Liquation

b. Leaching

c. Electrolysis

d. Hydraulic washing

e. Froth floatation

Choose the correct answer from the options given below :

(1) a and c only (2) b, d and e only (3) b, d and c only (4) c, d and e only

अयस्क के सान्द्रण में जो विधियाँ नहीं उपयोग की जाती हैं, वह हैं

a. द्रावगलन

b. निक्षालन

c. वैद्युत अपघटन

d. द्रवीय धावन

e. फेन प्लवन

नीचे दिए विकल्पों में से सही उत्तर चुनिए।

(1) a और c केवल (2) b, d और e केवल (3) b, d और c केवल (4) c, d और e केवल

Question ID: 366694575

Ans. Official Answer NTA (1)

Sol. Methods involved in concentration of one are

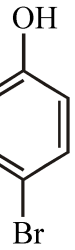
(i) Hydraulic Washing

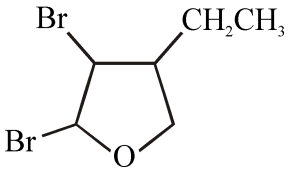
(ii) Froth Flotation

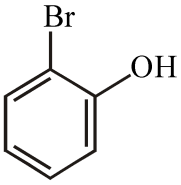
(iii) Magnetic Separation

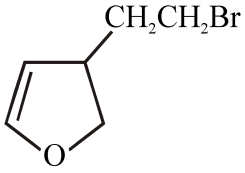
(iv) Leaching

6. An organic compound 'A' with emperical formula C_6H_6O gives sooty flame on buring. Its reaction with bromine solution in low polarity solvent results in high yield of B. B is

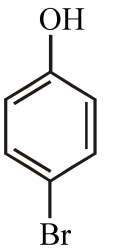
(1) 

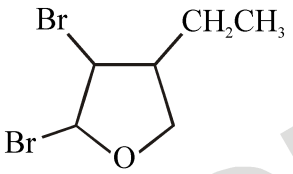
(2) 

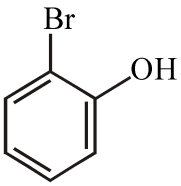
(3) 

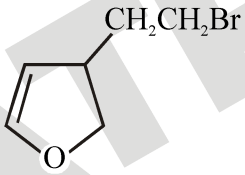
(4) 

एक कार्बनिक यौगिक जिसका मूलानुपाती सूत्र C_6H_6O है, जलाने पर कज्जली लौ देता है। इसकी न्यून ध्रुवीय विलायक में ब्रोमीन विलयन से अभिक्रिया का परिणाम B की उच्च लब्धि है। B है–

(1) 

(2) 

(3) 

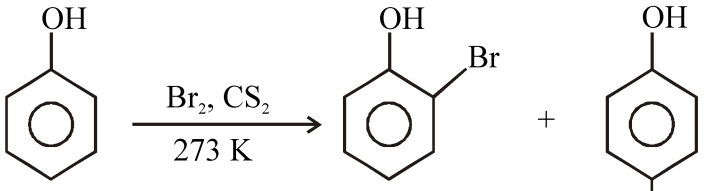
(4) 

Question ID: 366694585

Ans. Official Answer NTA (1)

Sol. Compound A is 

which gives sooty flame on burning.



(A) (Minor) (Major) (B)

7. When Cu^{2+} ion is treated with KI, a white precipitate, X appears in solution. The solution is titrated with sodium thiosulphate, the compound Y is formed. X and Y respectively are

(1) X = Cu_2I_2 Y = $Na_2S_4O_5$

(2) X = Cu_2I_2 Y = $Na_2S_4O_6$

(3) X = CuI_2 Y = $Na_2S_2O_3$

(4) X = CuI_2 Y = $Na_2S_4O_6$

जब Cu^{2+} आयन को KI से उपचारित करते हैं तो विलयन में एक सफेद अवक्षेप उत्पन्न होता है। विलयन का अनुमापन सोडियम थायोसल्फेट से करने पर यौगिक Y बनता है। X तथा Y क्रमशः हैं

(1) X = Cu_2I_2 Y = $Na_2S_4O_5$

(2) X = Cu_2I_2 Y = $Na_2S_4O_6$

(3) X = CuI_2 Y = $Na_2S_2O_3$

(4) X = CuI_2 Y = $Na_2S_4O_6$

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Ans. Official Answer NTA (2)

Sol. $2Cu^{2+} + 4KI \longrightarrow \underset{\text{White ppt.}}{Cu_2I_2} + I_2$

$I_2 + Na_2S_2O_3 \longrightarrow 2NaI + Na_2S_4O_6$

X = Cu_2I_2

Y = $Na_2S_4O_6$

8. Choose the correct set of reagents for the following conversion.

trans (Ph – CH = CH – CH_3) → cis (Ph – CH = CH – CH_3)

(1) Br_2, alc•KOH, $NaNH_2$, H_2 Lindlar Catalyst

(2) Br_2, aq•KOH, $NaNH_2$, H_2 Lindlar Catalyst

(3) Br_2, aq•KOH, $NaNH_2$, Na (Liq NH_3)

(4) Br_2, alc•KOH, $NaNH_2$, Na(Liq NH_3)

निम्नलिखित रूपांतरण के लिए अभिकर्मकों के सही सेट का चुनाव कीजिए।

trans (Ph – CH = CH – CH_3) → cis (Ph – CH = CH – CH_3)

(1) Br_2, alc•KOH, $NaNH_2$, H_2 लिन्डलर उत्प्रेरक

(2) Br_2, aq•KOH, $NaNH_2$, H_2 लिन्डलर उत्प्रेरक

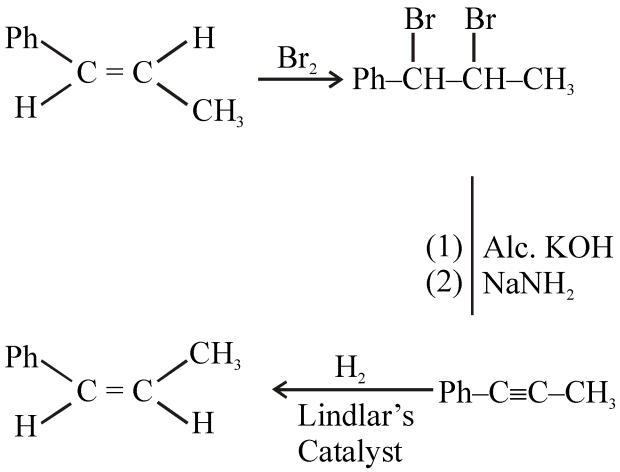
(3) Br_2, aq•KOH, $NaNH_2$, Na (द्रव NH_3)

(4) Br_2, alc•KOH, $NaNH_2$, Na(द्रव NH_3)

Question ID: 366694583

Ans. Official Answer NTA (1)

Sol.



9. Nd^{2+} = _____

(1) $4f^3$ (2) $4f^2 6s^2$ (3) $4f^4$ (4) $4f^4 6s^2$

Nd^{2+} = _____

(1) $4f^3$ (2) $4f^2 6s^2$ (3) $4f^4$ (4) $4f^4 6s^2$

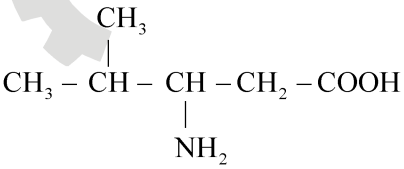
Question ID: 366694578

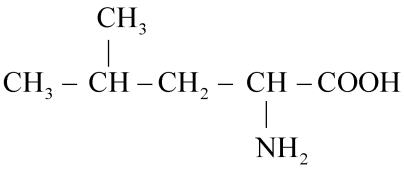
Ans. Official Answer NTA (3)

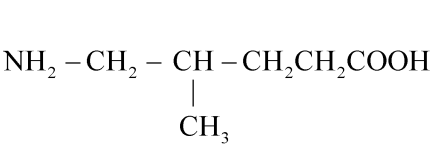
Sol. $Nd(Z = 60) = 4f^4 6s^2$

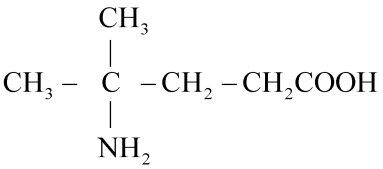
$Nd^{2+} = 4f^4$

10. A protein 'X' with molecular weight of 70,000 u, on hydrolysis gives amino acids. One of these amino acid is

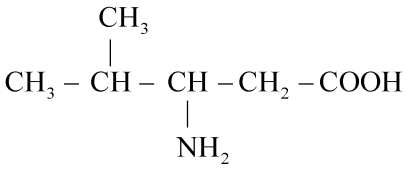
(1) 

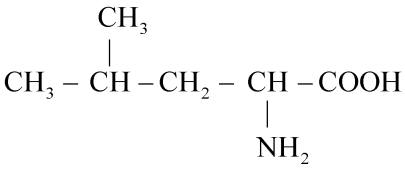
(2) 

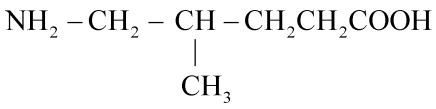
(3) 

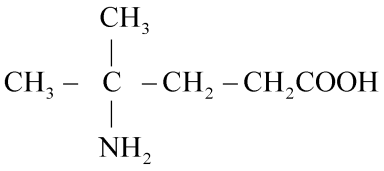
(4) 

आण्विक द्रव्यमान 70,000 u की प्रोटीन 'X' जल अपघटन पर ऐमीनो अम्ल देती है। उनमें से एक ऐमीनो अम्ल है–

(1) 

(2) 

(3) 

(4) 

Question ID: 366694589

Ans. Official Answer NTA (2)

Sol. Protein upon hydrolysis gives α-amino acids. Only option (2) contains α-amino acid. Hence the correct answer is (2).

11. Consider the following reaction

Propanal + Methanal $\xrightarrow[\text{(ii)}\,\Delta]{\text{(i)}\,\text{dil.NaOH}}$ Product B $(C_5H_8O_3)$ $\xrightarrow[\text{(iv)}\,H_3O^+]{\text{(iii)}\,NaCN}$

The correct statement for product B is. It is

(1) Optically active alcohol and is neutral

(2) Optically active and adds one mole of bromine

(3) Racemic mixture and gives a gas with saturated $NaHCO_3$ solution

(4) Racemic mixture and is neutral

निम्न अभिक्रिया पर विचार कीजिए

प्रोपेनैल + मेथेनैल $\xrightarrow[\text{(ii)}\,\Delta]{\text{(i)}\,\text{dil.NaOH}}$ उत्पाद B $(C_5H_8O_3)$ $\xrightarrow[\text{(iv)}\,H_3O^+]{\text{(iii)}\,NaCN}$

उत्पाद B के लिए सही कथन है, यह

(1) रेसिमिक मिश्रण है और उदासीन है।

(2) रेसिमिक मिश्रण है और $NaHCO_3$ के संतृप्त विलयन से एक गैस देता है।

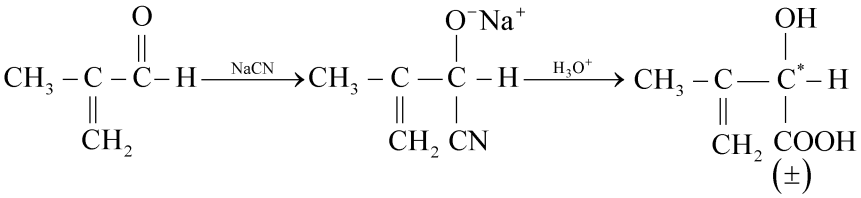
(3) प्रकाशिक सक्रिय है और ब्रोमीन का एक मोल संकलित कर लेता है।

(4) प्रकाशिक सक्रिय ऐल्कोहॉल है उदासीन है।

Question ID: 366694586

Ans. Official Answer NTA (3)

Sol. $CH_3-CH_2-CHO+HCHO \xrightarrow[\Delta]{OH^-}$



Carboxylic acid will give CO_2 gas, with $NaHCO_3$ solution

12. Match list-I with list-II

List-I		List-II	
a.	XeF_4	i.	See-saw
b.	SF_4	ii.	Square planar
c.	NH_4^+	iii.	Bent T-shaped
d.	BrF_3	iv.	Tetrahedral

Choose the correct answer from the options given below :

(1) a - iv, b - iii, c - ii, d - i

(2) a - ii, b - i, c - ii, d - iv

(3) a - iv, b - i, c - ii, d - iii

(4) a - ii, b - i, c - iv, d - iii

सूची I तथा सूची II का मिलान कीजिए।

सूची-I		सूची-II	
a.	XeF_4	i.	ढेकुली
b.	SF_4	ii.	वर्ग समतली
c.	NH_4^+	iii.	मुड़ी हुयी T-आकृति
d.	BrF_3	iv.	चतुष्फलकीय

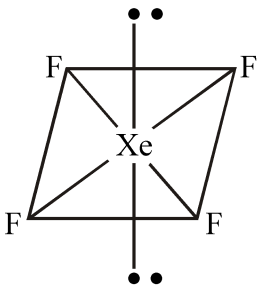
नीचे दिए विकल्पों में से सही उत्तर चुनिए।

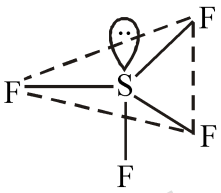
(1) a - iv, b - iii, c - ii, d - i (2) a - ii, b - i, c - ii, d - iv

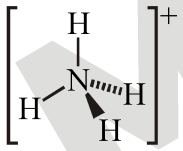
(3) a - iv, b - i, c - ii, d - iii (4) a - ii, b - i, c - iv, d - iii

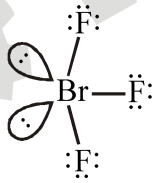
Question ID: 366694572

Ans. Official Answer NTA (4)

Sol. (A) XeF_4 –  Square Planar

(B) SF_4 –  See saw

(C) NH_4^+ –  Tetrahedral

(D) BrF_3 –  Bent-t-shaped

13. Which transition in the hydrogen spectrum would have the same wavelength as the balmer type transition from n = 4 to n = 2 of He^+ spectrum

(1) n = 2 to n = 1 (2) n = 1 to n = 3 (3) n = 3 to n = 4 (4) n = 1 to n = 2

हाइड्रोजन स्पेक्ट्रम के कौनसे संक्रमण की तरंगदैर्ध्य, He^+ स्पेक्ट्रम के बामर प्रकाश के n = 4 to n = 2 संक्रमण की तरंगदैर्ध्य के समान होगी?

(1) n = 2 to n = 1 (2) n = 1 to n = 3 (3) n = 3 to n = 4 (4) n = 1 to n = 2

Question ID: 366694571

Ans. Official Answer NTA (1)

Sol. $\bar{\nu}_{He^+} = \frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]z^2$

$= R\left[\frac{1}{(2)^2} - \frac{1}{(4)^2}\right]4$

$= R\left[\frac{1}{1} - \frac{1}{4}\right]$

$= \frac{3}{4}R$

$\bar{\nu}_{2\to1} = \frac{1}{\lambda} = R\left[\frac{1}{n_1^2} - \frac{1}{n_2^2}\right]$

$= R\left[\frac{1}{1} - \frac{1}{(2)^2}\right]$

$= \frac{3}{4}R$

14. The correct increasing order of the ionic radii is

(1) $Ca^{2+} < K^+ < Cl^- < S^{2-}$ (2) $Cl^- < Ca^{2+} < K^+ < S^{2-}$

(3) $K^+ < S^{2-} < Ca^{2+} < Cl^-$ (4) $S^{2-} < Cl^- < Ca^{2+} < K^+$

आयनिक त्रिज्याओं के बढ़ने का सही क्रम है :

(1) $Ca^{2+} < K^+ < Cl^- < S^{2-}$ (2) $Cl^- < Ca^{2+} < K^+ < S^{2-}$

(3) $K^+ < S^{2-} < Ca^{2+} < Cl^-$ (4) $S^{2-} < Cl^- < Ca^{2+} < K^+$

Question ID: 366694574

Ans. Official Answer NTA (1)

Sol. In isoelectronic species size $\propto \frac{1}{Z}$

$Ca^{2+} < K^+ < Cl^- < S^{2-}$: Size

Z: 20 19 17 18

15. H_2O_2 acts as a reducing agent in

(1) $2NaOCl + H_2O_2 \rightarrow 2NaCl + H_2O + O_2$

(2) $Na_2S + 4H_2O_2 \rightarrow Na_2SO_4 + 4H_2O$

(3) $Mn^{2+} + 2H_2O_2 \rightarrow MnO_2 + 2H_2O$

(4) $2Fe^{2+} + 2H^+ + H_2O_2 \rightarrow 2Fe^{3+} + 2H_2O$

H_2O_2 एक अपचायक कर्मक के रूप में जिसमें कार्य करता है, वह अभिक्रिया है।

(1) $2NaOCl + H_2O_2 \rightarrow 2\,NaCl + H_2O + O_2$

(2) $Na_2S + 4H_2O_2 \rightarrow Na_2SO_4 + 4H_2O$

(3) $Mn^{2+} + 2H_2O_2 \rightarrow MnO_2 + 2H_2O$

(4) $2Fe^{2+} + 2H^+ + H_2O_2 \rightarrow 2Fe^{3+} + 2H_2O$

Question ID: 366694576

Ans. Official Answer NTA (1)

Sol. H_2O_2 acts an reducing agent in the following reaction.

$NaOCl + H_2O_2 \longrightarrow 2NaCl + H_2O + O_2$

16. Which of the following artificial sweeteners has the highest sweetness value in comparison to cane sugar ?

(1) Saccharin (2) Alitame (3) Aspartame (4) Sucralose

केन शुगर की तुलना में निम्नलिखित कृत्रिम मधुरकों में से किसका माधुर्य सर्वाधिक हैं?

(1) सैकरीन (2) ऐलिटेम (3) ऐस्पार्टेम (4) सूक्रालोस

Question ID: 366694588

Ans. Official Answer NTA (2)

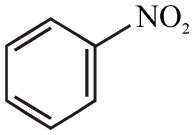
Sol. Highest sweetness value is of Alitame

Sucralose = 600

Aspartame = 100

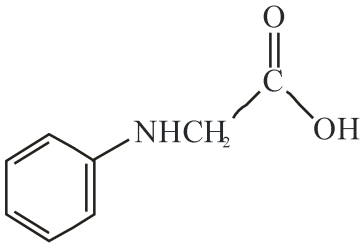
Saccharin = 550

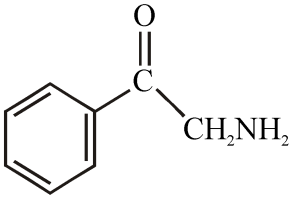
Alitame = 2000

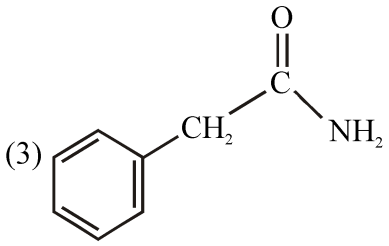
17. 

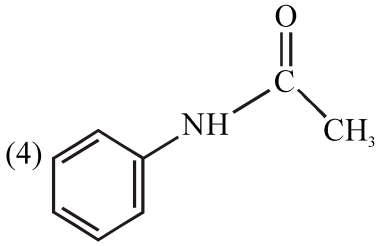
$\xrightarrow[C_2H_5OH]{H_2/Pd}[A]\xrightarrow[Pyridine]{(CH_3CO)_2O}[B]$

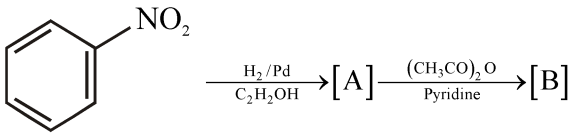
Consider the above reaction and identify the product B.

(1) 

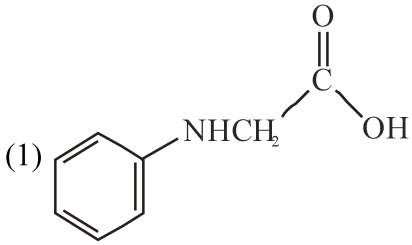
(2) 

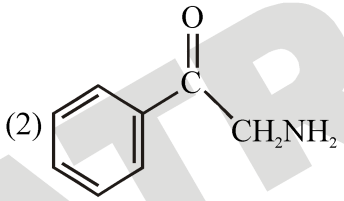
(3) 

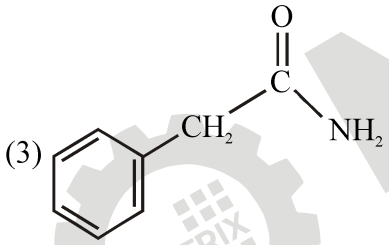
(4) 

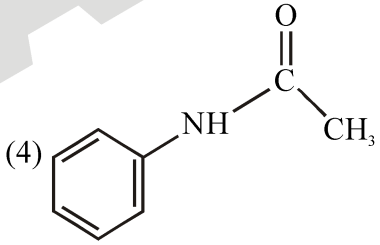


उपरोक्त अभिक्रिया पर विचार कीजिए तथा उत्पाद B को पहचानिए।

(1) 

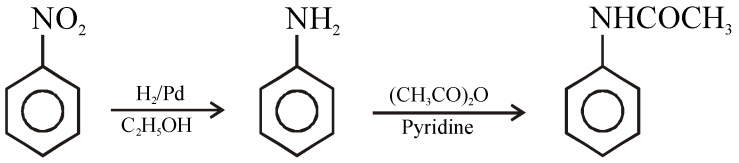
(2) 

(3) 

(4) 

Question ID: 366694587

Ans. Official Answer NTA (4)

Sol. 

18. Cobalt chloride when dissolved in water forms pink colored complex X which has octahedral geometry. This solution on treating with conc HCl forms deep blue complex, Y which has a Z geometry. X, Y and Z, respectively, are

(1) X = $[Co(H_2O)_6]^{2+}$, Y = $[CoCl_4]^{2-}$, Z = Tetrahedral

(2) X = $[Co(H_2O)_6]^{3+}$, Y = $[CoCl_6]^{3-}$, Z = Octahedral

(3) X = $[Co(H_2O)_4Cl_2]^+$, Y = $[CoCl_4]^{2-}$, Z = Tetrahedral

(4) X = $[Co(H_2O)_6]^{2+}$, Y = $[CoCl_6]^{3-}$, Z = Octahedral

कोबॉल्ट क्लोराइड को जब जल में घोलते हैं तो पिंक रंग का संकुल X बनता है जिसकी ज्यामिति अष्टफलकीय होती है। इस विलयन का सान्द्र HCl से उपचार करने पर गहरे नीले रंग का संकुल Y प्राप्त होता है जिसकी ज्यामिति Z है। X, Y तथा Z क्रमशः हैं :

(1) X = $[Co(H_2O)_6]^{2+}$, Y = $[CoCl_4]^{2-}$, Z = चतुष्फलकीय

(2) X = $[Co(H_2O)_6]^{3+}$, Y = $[CoCl_6]^{3-}$, Z = अष्टफलकीय

(3) X = $[Co(H_2O)_4Cl_2]^+$, Y = $[CoCl_4]^{2-}$, Z = चतुष्फलकीय

(4) X = $[Co(H_2O)_6]^{2+}$, Y = $[CoCl_6]^{3-}$, Z = अष्टफलकीय

Question ID: 366694580

Ans. Official Answer NTA (1)

Sol.

$$CoCl_2 \xrightarrow{H_2O} \underset{(Octahedral)}{\left[Co(H_2O)_6\right]^{2+}}(X) \xrightarrow{\text{conc HCl}} [CoCl_4]^{2-}(Y)$$

Tetrahedral (Z)

19. Which one of the following statements is correct for electrolysis of brine solution ?

(1) OH^- is formed at cathode (2) O_2 is formed at cathode

(3) Cl_2 is formed at cathode (4) H_2 is formed at anode

ब्राइन विलयन के विद्युत अपघटन के लिए निम्नलिखित कथनों में से कौनसा एक सही है?

(1) OH^- कैथोड पर बनता है। (2) O_2 कैथोड पर बनती है।

(3) Cl_2 कैथोड पर बनती है। (4) H_2 एनोड पर बनती है।

Question ID: 366694577

Ans. Official Answer NTA (1)

Sol. Electrolysis of brine solution

$$NaCl(aq.) \longrightarrow Na^+_{(aq)} + Cl^+_{(aq)}$$

At anode : $\underset{(Major)}{2Cl^+_{(aq.)} \longrightarrow Cl_2(g) + 2e^-}$

$$\underset{Minor}{2H_2O_{(\ell)} \longrightarrow O_{2(g)} + 4H^+_{(aq)} + 4e^-}$$

At Cathode : $2H_2O_{(\ell)} + 2e^- \longrightarrow H_{2(g)} \uparrow + 2OH^-_{(aq)}$

$2Na^+ + 2OH^- \longrightarrow 2NaOH$

20. Identify X, Y and Z in the following reaction. (Equation not balanced)

$ClO^\bullet + NO_2 \rightarrow \underline{X} \xrightarrow{H_2O} \underline{Y} + \underline{Z}$

(1) X = $ClONO_2$, Y = HOCl, Z = NO_2 (2) X = $ClNO_2$, Y = HCl, Z = HNO_3

(3) X = $ClNO_3$, Y = Cl_2, Z = NO_2 (4) X = $ClONO_2$, Y = HOCl, Z = HNO_3

निम्नलिखित अभिक्रिया में X, Y तथा Z को पहचानिए। (समीकरण संतुलित नहीं है)

$ClO^\bullet + NO_2 \rightarrow \underline{X} \xrightarrow{H_2O} \underline{Y} + \underline{Z}$

(1) X = $ClONO_2$, Y = HOCl, Z = NO_2 (2) X = $ClNO_2$, Y = HCl, Z = HNO_3

(3) X = $ClNO_3$, Y = Cl_2, Z = NO_2 (4) X = $ClONO_2$, Y = HOCl, Z = HNO_3

Question ID: 366694581

Ans. Official Answer NTA (4)

Sol. $\dot{Cl}O(g) + NO_2(g) \longrightarrow ClONO_2(g)$

$ClONO_2(g) + H_2O(g) \longrightarrow HOCl + HNO_3(g)$

from NCERT

21. The total pressure of a mixture of non-reacting gases X (0.6 g) and Y (0.45 g) in a vessel is 740 mm of Hg. The partial pressure of the gas X is _____ mm of Hg. (Nearest Integer)

(Given : molar mass X = 20 and Y = 45 g mol^{-1})

दो गैस X तथा Y की आण्विक संहति क्रमशः 20 तथा 45 g mol^{-1} है। इनके क्रमशः 0.6 g तथा 0.45 g को एक बर्तन में रखने पर मिश्रण का कुल दाब 740 mm Hg है। गैस X का आंशिक दाब है _____ mm Hg (निकटतम पूर्णांक में)

Question ID: 366694592

Ans. Official Answer NTA (555)

Sol. P_{Total} = 740 mm of Hg

P_X = mole fraction of [X] P_{Total}

$n_X = \frac{0.6}{20} = 0.03$

$n_Y = \frac{0.45}{45} = 0.01$

Mole fraction of X $= \frac{0.03}{0.01+0.03} = \frac{3}{4}$

Partial pressure of X $= \frac{3}{4} \times 740$

$= 555$ mm of Hg

22. $A \rightarrow B$

The rate constant of the above reaction at 200 K and 300 K are 0.03 min^{-1} and 0.05 min^{-1} respectively. The activation energy for the reaction is _____ J (Nearest integer)

(Given : ln 10 = 2.3)

R = 8.3 J K^{-1} mol^{-1}

log 5 = 0.70

log 3 = 0.48

log 2 = 0.30

Given : 1096

$A \rightarrow B$

उपरोक्त अभिक्रिया के लिए 200 K तथा 300 K पर वेग स्थिरांक क्रमशः 0.03 min^{-1} तथा 0.05 min^{-1} हैं। अभिक्रिया के लिए सक्रियण ऊर्जा है _____ J (निकटतम पूर्णांक में)

(दिया गया है : ln 10 = 2.3)

R = 8.3 J K^{-1} mol^{-1}

log 5 = 0.70

log 3 = 0.48

log 2 = 0.30

Question ID: 366694597

Ans. Official Answer NTA (2520)

Sol. $\log \frac{K_{300}}{K_{200}} = \frac{E_a}{2.3 \times 8.314}\left(\frac{1}{T_1} - \frac{1}{T_2}\right)$

$\log \frac{0.05}{0.03} = \frac{E_a}{2.305 \times 8.314} \times \left[\frac{1}{200} - \frac{1}{300}\right]$

$E_a = 2519.88 \text{ J} \Rightarrow E_a = 2520 \text{ J}$

23. For reaction : $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$

$K_p = 2 \times 10^{12}$ at 27°C and 1 atm pressure. The K_C for the same reaction is _____ $\times 10^{13}$. (Nearest integer)
(Given R = 0.082 L atm K^{-1} mol^{-1})

अभिक्रिया : $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$ के लिए

27°C तथा 1 atm दाब पर $K_p = 2 \times 10^{12}$ है। इसी अभिक्रिया के लिए K_c है _____ $\times 10^{13}$ है (निकटतम पूर्णांक में)

(दिया है : R = 0.082 L atm K^{-1} mol^{-1})

Given : 1

Question ID: 366694595

Ans. Official Answer NTA (1)

Sol. $SO_{2_{(g)}} + \frac{1}{2}O_{2_{(g)}} \rightleftharpoons SO_{3_{(g)}}$

$K_p = K_c(RT)^{\Delta n}$

$2 \times 10^{12} = K_c(0.082 \times 300)^{-1/2}$

$K_c = 2 \times 10^{12} \times (0.082 \times 300)^{1/2}$

$= 9.9 \times 10^{12}$

$= 0.99 \times 10^{13}$

$\approx 1 \times 10^{13}$

24. At 27°C, a solution containing 2.5 g of solute in 250.0 mL of solution exerts an osmotic pressure of 400 Pa. The molar mass of the solute is _____ g mol^{-1} (Nearest integer)

(Given : R = 0.083 L bar K^{-1} mol^{-1})

27°C पर 2.5 g विलेय का 250.0 mL विलयन 400 Pa. का परासरण दाब उत्पन्न करता है। विलेय की मोलर संहति _____ g mol^{-1} है। (निकटतम पूर्णांक में)

(दिया है : R = 0.083 L bar K^{-1} mol^{-1})

Question ID: 366694594

Ans. Official Answer NTA (62250)

Sol. $\pi = CRT$

$$\frac{400\text{Pa}}{10^5} = \frac{\frac{2.5\text{g}}{M_o}}{250/1000\text{L}} \times 0.83 \frac{\text{L} - \text{bar}}{\text{K.mol}} \times 300\text{K}$$

$M_o = 62250$

25. The logarithm of equilibrium constant for the reaction $Pd^{2+} + 4Cl^- \rightleftharpoons PdCl_4^{2-}$ is _____ (Nearest integer)

Given : $\frac{2.303RT}{F} = 0.06V$

$Pd^{2+}_{(aq)} + 2e^- \rightleftharpoons Pd(s) \quad E^\Theta = 0.83V$

$PdCl_4^{2-}(aq) + 2e^- \rightleftharpoons Pd(s) + 4Cl^-(aq) \quad E^\Theta = 0.65V$

अभिक्रिया $Pd^{2+} + 4Cl^- \rightleftharpoons PdCl_4^{2-}$ के लिए साम्य नियतांक का लॉगरिदम है _____ (निकटतम पूर्णांक में)

दिया है : $\frac{2.303RT}{F} = 0.06V$

$Pd^{2+}_{(aq)} + 2e^- \rightleftharpoons Pd(s) \quad E^\Theta = 0.83V$

$PdCl_4^{2-}(aq) + 2e^- \rightleftharpoons Pd(s) + 4Cl^-(aq) \quad E^\Theta = 0.65V$

Given : 6

Question ID: 366694596

Ans. Official Answer NTA (6)

Sol. Given reaction $Pd^{2+} + 4Cl^- \rightleftharpoons [PdCl_4]^{2-}$

$E^o_{cell} = E^o_{Pd^{2+}|Pd} - E^o_{(PdCl_4)^{2-}|Pd}$

$= 0.83 - 0.65$

$= 0.18$

$E^o_{cell} = \frac{0.06}{2}\log K_{eq}$

$0.18 = \frac{0.06}{2}\log K_{eq}$

$\log K_{eq} = 6$

26. The enthalpy change for the conversion of $\frac{1}{2}Cl_2(g)$ to $Cl^-(aq)$ is (–) _____ kJ mol^{-1} (Nearest integer)

Given : $\Delta_{dis}H^\Theta_{Cl_{2(g)}} = 240$ kJ mol^{-1}, $\Delta_{eg}H^\Theta_{Cl_{(g)}} = -350$ kJ mol^{-1},

$\Delta_{hyd}H^\Theta_{Cl^-_{(g)}} = -350$ kJ mol^{-1}

$\frac{1}{2}Cl_2(g)$ से $Cl^-(aq)$ में रूपान्तरण के लिए एंथैल्पी परिवर्तन है (–) _____ kJ mol^{-1} (निकटतम पूर्णांक में)

दिया है : $\Delta_{dis}H^\Theta_{Cl_{2(g)}} = 240$ kJ mol^{-1}, $\Delta_{eg}H^\Theta_{Cl_{(g)}} = -350$ kJ mol^{-1},

$\Delta_{hyd}H^\Theta_{Cl^-_{(g)}} = -350$ kJ mol^{-1}

Question ID: 366694593

Ans. Official Answer NTA (610)

Sol. $\frac{1}{2}Cl_2(g) \longrightarrow Cl^-_{(aq)} \quad \Delta H = ?$

$\Delta H = \frac{1}{2}\Delta_{diss}H^o_{Cl_2} + \Delta_{eg}\Delta H^o_{Cl(g)} + \Delta_{hyd}H^o_{Cl^-_{(g)}}$

$= \frac{1}{2} \times 240 + (-350) + (-380)$

$= -610 kJ\,mol^-$

27. Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP form the reaction of 11.5 g of zinc with excess HCl is _____ L (Nearest integer)
(Given : Molar mass of Zn is 65.4g mol^{-1} and Molar volume of H_2 at STP = 22.7 L)
जिंक से हाइड्रोक्लोरिक अम्ल की अभिक्रिया होने पर हाइड्रोजन तथा जिंक क्लोराइड उत्पन्न होता है। यदि 11.5 g जिंक की HCl के आधिक्य से अभिक्रिया की जाय तो STP पर उत्पन्न हाइड्रोजन गैस का आयतन होगा _____ L (निकटतम पूर्णांक में)
(दिया है : जिंक का मोलर संहति है 65.4 g mol^{-1})

Question ID: 366694591

Ans. Official Answer NTA (4)

Sol. $Zn + 2HCl \rightarrow ZnCl_2 + H_2 \uparrow$

Moles of Zn used $= \frac{11.5}{65.4}$ = Moles of H_2 evolved

Volume of $H_2 = \frac{11.5}{65.4} \times 22.7L = 3.99L$

28. On complete combustion, 0.492 g of an organic compound gave 0.792 g of CO_2. The % of carbon in the organic compound is _____ (Nearest integer)
0.492 g कार्बनिक यौगिक का पूर्ण दहन 0.792 g CO_2 देता है। कार्बनिक यौगिक में कार्बन का प्रतिशत _____ है। (निकटतम पूर्णांक में)

Question ID: 366694599

Ans. Official Answer NTA (44)

Sol. 44 gm of CO_2 contains 12 g carbon

0.792 gm of CO_2 contains $\frac{0.792 \times 12}{4}$ g of carbon

% of carbon $= \frac{0.216}{0.492} \times 100$

$= 43.9\% \simeq 44\%$

29. The oxidation state of phosphorus in hypophosphoric acid is + _____ .

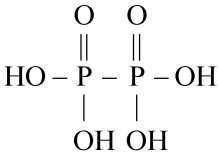
हाइपोफॉस्फोरिक अम्ल में फॉस्फोरस की ऑक्सीकरण अवस्था है _____ .

Question ID: 366694598

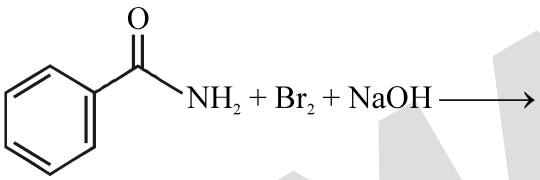
Ans. Official Answer NTA (4)

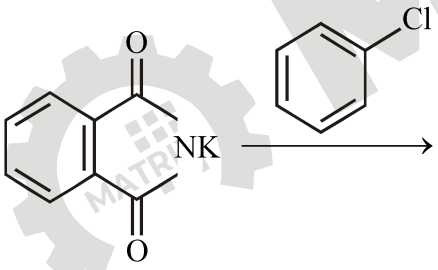
Sol. Hypophosphoric acid $H_4P_2O_6$

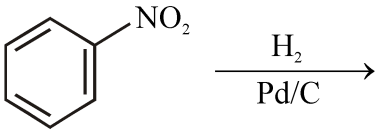
Oxidation state is +4

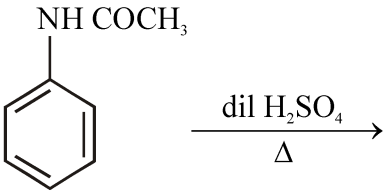


30. How many of the transformations given below would result in aromatic amines ?

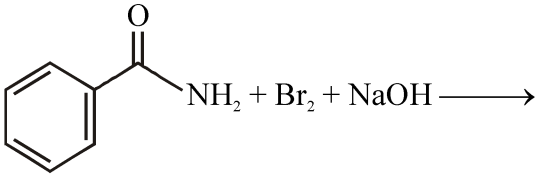
(1) 

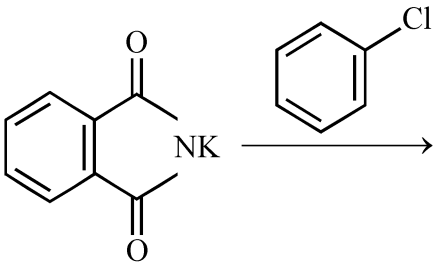
(2) 

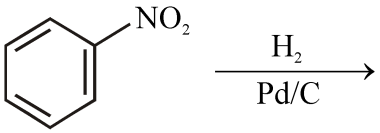
(3) 

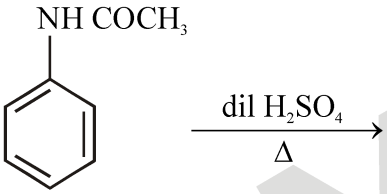
(4) 

नीचे दिये रूपान्तरणों में से कितनों का परिणाम ऐरोमैटिक ऐमीनों के रूप में होगा।

(1) 

(2) 

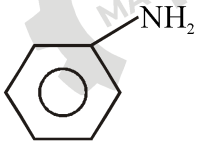
(3) 

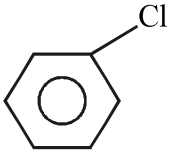
(4) 

Question ID: 366694600

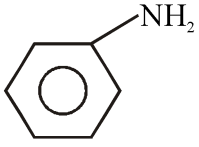
Ans. Official Answer NTA (3)

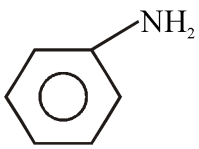
Sol. Product in the given reactions are as follow-

1. 

2. No reactions will be observed as in Gabriel phthalimide synthesis 

is poor substrate for SN^2

3. 

4. 

+ CH_3COOH

Aromatic amines will he formed in 1, 3 & 4