

JEE Main 2023 (1st Attempted)
(Shift - 01 Chemistry Paper)

31.01.2023

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

31. $\text{Nd}^{2+} =$ _____

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

Official Ans. by NTA (2)

Allen Ans. (2)

Sol $\text{Nd}(60) = [\text{Xe}] 4f^4 5d^0 6s^2$
 $\text{Nd}^{2+} = [\text{Xe}] 4f^4 5d^0 5s^0$

32. The methods NOT involved in concentration of ore are

- (A) Liquefaction
(B) Leaching
(C) Electrolysis
(D) Hydraulic washing
(E) Froth floatation

Choose the correct answer from the options given below :

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

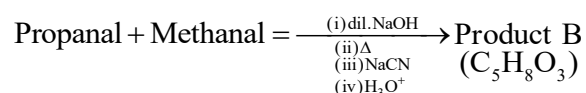
Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Methods involved in concentration of one are

- (i) Hydraulic Washing
(ii) Froth Flotation
(iii) Magnetic Separation
(iv) Leaching

33. Consider the following reaction



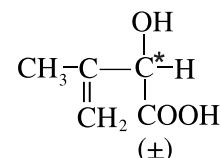
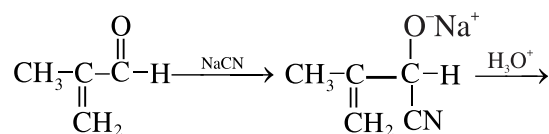
The correct statement for product B is. It is

- (1) optically active and adds one mole of bromine
(2) racemic mixture and is neutral
(3) racemic mixture and gives a gas with saturated NaHCO_3 solution
(4) optically active alcohol and is neutrall

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $\text{CH}_3-\text{CH}_2-\text{CHO} + \text{HCHO} \xrightarrow[\Delta]{\text{OH}^-}$



Carboxylic acid will give CO_2 gas, with NaHCO_3 solution

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

- (1) $\text{V}_2\text{O}_3 > \text{V}_2\text{O}_4 > \text{V}_2\text{O}_5$
(2) $\text{V}_2\text{O}_3 > \text{V}_2\text{O}_5 > \text{V}_2\text{O}_4$
(3) $\text{V}_2\text{O}_5 > \text{V}_2\text{O}_4 > \text{V}_2\text{O}_3$
(4) $\text{V}_2\text{O}_4 > \text{V}_2\text{O}_3 > \text{V}_2\text{O}_5$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. With increase in % of oxygen acidic nature of oxide of an element increase and basic nature decreases

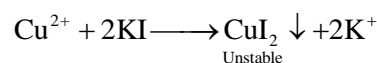
35. When Cu^{2+} ion is treated with KI, a white precipitate, X appears in solution. The solution is titrated with sodium thiosulphate, the compound Y is formed. X and Y respectively are

- (1) $\text{X} = \text{Cu}_2\text{I}_2$ $\text{Y} = \text{Na}_2\text{S}_4\text{O}_5$
(2) $\text{X} = \text{Cu}_2\text{I}_2$ $\text{Y} = \text{Na}_2\text{S}_4\text{O}_6$
(3) $\text{X} = \text{CuI}_2$ $\text{Y} = \text{Na}_2\text{S}_4\text{O}_3$
(4) $\text{X} = \text{CuI}_2$ $\text{Y} = \text{Na}_2\text{S}_4\text{O}_6$

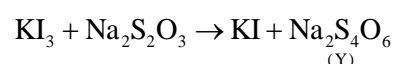
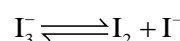
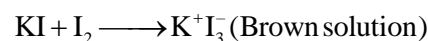
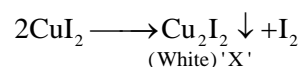
Official Ans. by NTA (2)

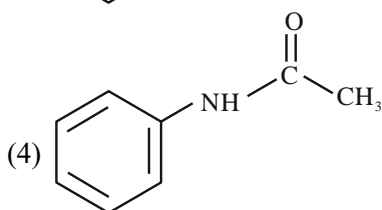
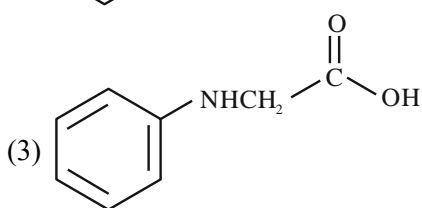
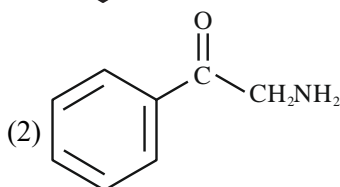
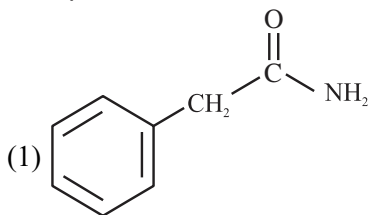
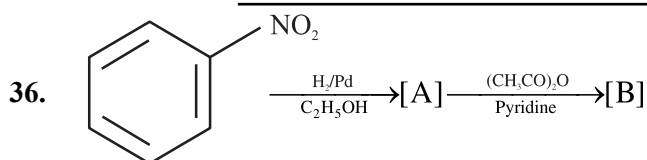
Allen Ans. (2)

Sol.



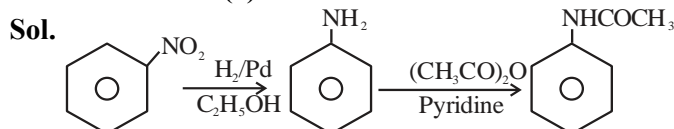
I^- is strong R.A it reduces Cu^{2+} to Cu^+





Official Ans. by NTA (4)

Allen Ans. (4)



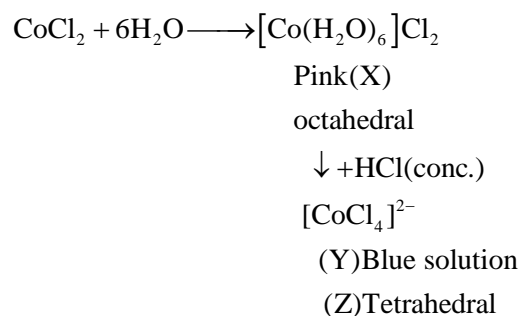
37. Cobalt chloride when dissolved in water forms pink colored complex X which has octahedral geometry. This solution on treating with cone HCl forms deep blue complex, Y which has a Z geometry. X, Y and Z, respectively, are

- (1) $X=[Co(H_2O)_6]^{2+}$, $Y=[CoCl_4]^{2-}$, Z=Tetrahedral
 (2) $X=[Co(H_2O)_6]^{2+}$, $Y=[CoCl_6]^{3-}$, Z=Octahedral
 (3) $X=[Co(H_2O)_6]^{3+}$, $Y=[CoCl_6]^{3-}$, Z=Octahedral
 (4) $X=[Co(H_2O)_4Cl_2]^+$, $Y=[CoCl_4]^{2-}$, Z=Tetrahedral

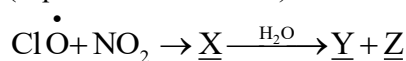
Official Ans. by NTA (1)

Allen Ans. (1)

Sol.



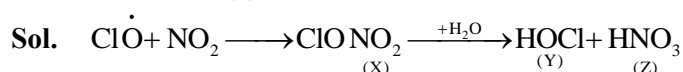
38. Identify X, Y and Z in the following reaction. (Equation not balanced)



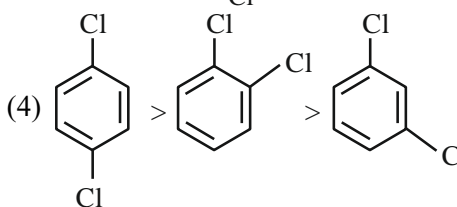
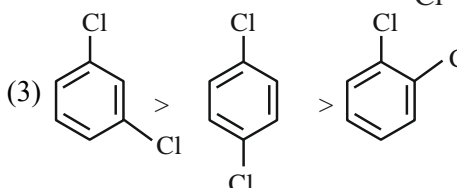
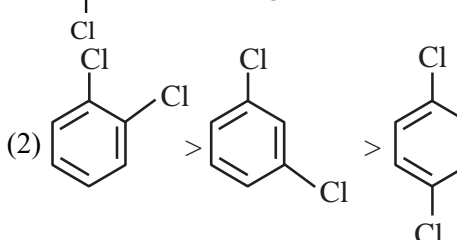
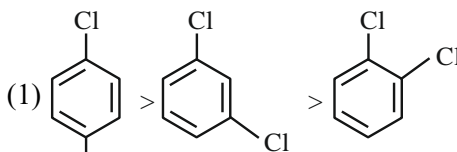
- (1) $X=ClONO_2$, $Y=HOCl$, $Z=NO_2$
 (2) $X=ClNO_2$, $Y=HCl$, $Z=HNO_3$
 (3) $X=ClONO_2$, $Y=HOCl$, $Z=HNO_3$
 (4) $X=ClNO_3$, $Y=Cl_2$, $Z=NO_2$

Official Ans. by NTA (3)

Allen Ans. (3)



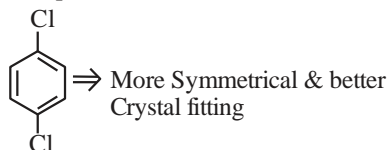
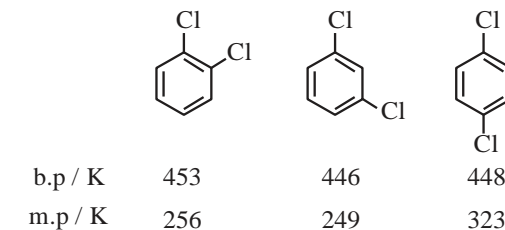
39. The correct order of melting point of dichlorobenzenes is



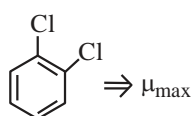
Official Ans. by NTA (4)

Allen Ans. (4)

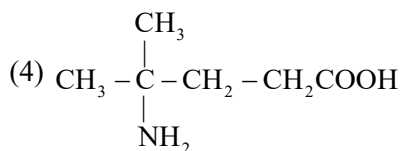
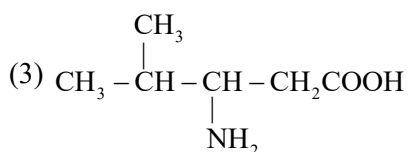
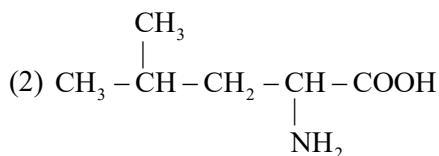
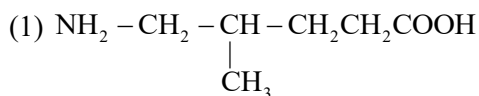
Sol.



M.P a Packing efficiency



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



Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Only in option (2) α -Amino acid is given all the other options are not α -Amino acids.

41. 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) $n=1$ to $n=2$
- (4) $n=3$ to $n=4$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. He^+ ion :

$$\frac{1}{\lambda(\text{H})} = R(1)^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right]$$

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

Given $\lambda(\text{H}) = \lambda(\text{He}^+)$

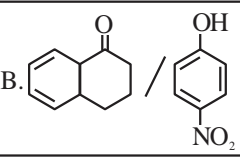
$$R(1)^2 \left[\frac{1}{n_1^2} - \frac{1}{n_2^2} \right] = R(4)^2 \left[\frac{1}{2^2} - \frac{1}{4^2} \right]$$

$$\frac{1}{n_1^2} - \frac{1}{n_2^2} = \frac{1}{1^2} - \frac{1}{2^2}$$

On comparing $n_1=1$ & $n_2=2$

Ans. 1

42. Match items of column I and II

Column I (Mixture of compounds)	Column II (Separation Technique)
A. $\text{H}_2\text{O}/\text{CH}_2\text{Cl}_2$	i. Crystallization
B. 	ii. Differential solvent extraction
C. Kerosene/Naphthalene	iii. Column chromatography
D. $\text{C}_6\text{H}_{12}\text{O}_6/\text{NaCl}$	iv. Fractional Distillation

Correct match is :

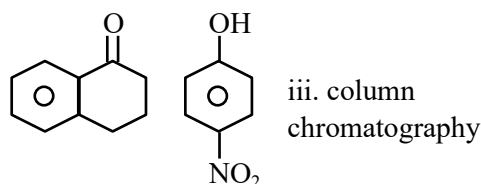
- (1) A-(iii), B-(iv), C-(ii), D-(i)
- (2) A-(i), B-(iii), C-(ii), D-(iv)
- (3) A-(ii), B-(iii), C-(iv), D-(i)
- (4) A-(ii), B-(iv), C-(i), D-(iii)

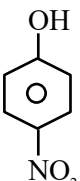
Official Ans. by NTA (3)

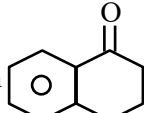
Allen Ans. (3)

Sol. A. $\text{H}_2\text{O}/\text{CH}_2\text{Cl}_2 \rightarrow$ ii, $\text{CH}_2\text{Cl}_2 > \text{H}_2\text{O}$ (density) so they can be separated by differential solvent extraction.

B.



Due to H-bonding in  it can be separated

from  by column chromatography.

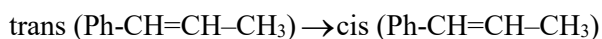
C. Kerosene / Naphthalene \rightarrow iv. Fractional distillation.

Due to different B.P. of kerosene and Naphthalene it can be separated by fractional distillation.

D. $\text{C}_6\text{H}_{12}\text{O}_6/\text{NaCl} \rightarrow$ i. Crystallization.

NaCl (ionic compound) can be crystallized.

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

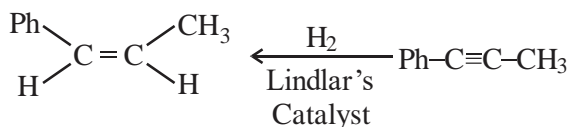
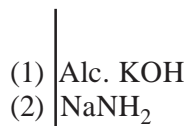
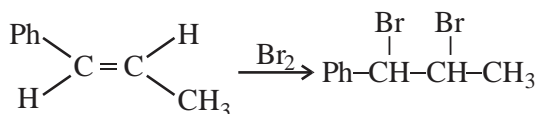


- (1) $\text{Br}_2, \text{alc KOH, NaNH}_2, \text{Na(Liq NH}_3\text{)}$
- (2) $\text{Br}_2, \text{alc KOH, NaNH}_2, \text{H}_2\text{Lindlar Catalyst}$
- (3) $\text{Br}_2, \text{aq KOH, NaNH}_2, \text{H}_2\text{Lindlar Catalyst}$
- (4) $\text{Br}_2, \text{aq KOH, NaNH}_2, \text{Na(Liq NH}_3\text{)}$

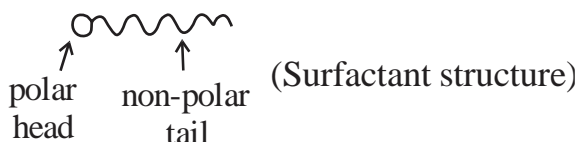
Official Ans. by NTA (2)

Allen Ans. (2)

Sol.



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



- | | | | |
|-----|-------------------|-----|-------------------|
| (a) | Non Polar Solvent | (b) | Non Polar Solvent |
| | | | |
| (c) | Non Polar Solvent | (d) | Non Polar Solvent |
| | | | |

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

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Non-Polar tail towards non-polar solvent

Ans. 3

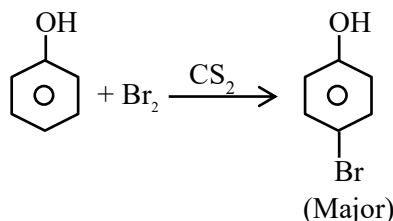
49. An organic compound 'A' with empirical formula $\text{C}_6\text{H}_6\text{O}$ gives sooty flame on burning. Its reaction with bromine solution in low polarity solvent results in high yield of B. B is

- (1)
- (2)
- (3)
- (4)

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Aromatic compounds burns with sooty flame



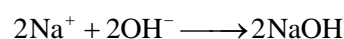
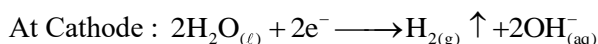
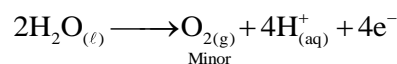
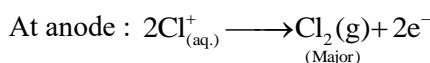
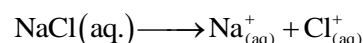
50. Which one of the following statements is correct for electrolysis of brine solution?

- (1) Cl_2 is formed at cathode
- (2) O_2 is formed at cathode
- (3) H_2 is formed at anode
- (4) OH^- is formed at cathode

Official Ans. by NTA (4)

Allen Ans. (4)

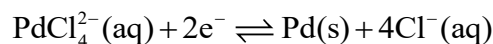
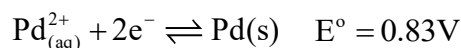
Sol. Electrolysis of brine solution



SECTION-B

51. The logarithm of equilibrium constant for the reaction $\text{Pd}^{2+} + 4\text{Cl}^- \rightleftharpoons \text{PdCl}_4^{2-}$ is _____ (Nearest integer)

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



$$E^\circ = 0.65V$$

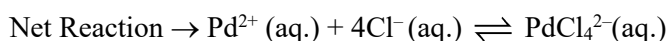
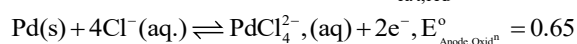
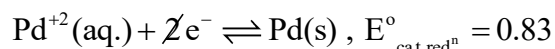
Official Ans. by NTA (6)

Allen Ans. (6)

Sol. $\Delta G^\circ = -RT \ln K$

$$-nFE_{\text{cell}}^\circ = -RT \times 2.303(\log_{10} K)$$

$$\frac{E_{\text{cell}}^\circ}{0.06} \times n = \log K \quad \dots(1)$$



$$E_{\text{cell}}^\circ = E_{\text{cat, red}}^\circ - E_{\text{Anode, Oxid}}^\circ$$

$$E_{\text{cell}}^\circ = 0.83 - 0.65$$

$$E_{\text{cell}}^\circ = 0.18 \quad \dots(2)$$

$$\text{Also } n = 2 \quad \dots(3)$$

Using equation (1), (2) & (3)

$$\log K = 6$$

52. $A \rightarrow B$

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

(Given : $\ln 10 = 2.3$)

$$R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$$

$$\log 5 = 0.70$$

$$\log 3 = 0.48$$

$$\log 2 = 0.30$$

Official Ans. by NTA (2520)

Allen Ans. (2520)

Sol.

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

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

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

53. The enthalpy change for the conversion of $\frac{1}{2} \text{Cl}_2(\text{g})$ to $\text{Cl}^-(\text{aq})$ is (-) _____

kJ mol^{-1} (Nearest integer)

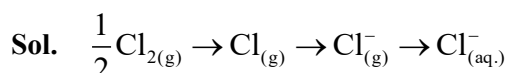
$$\text{Given: } \Delta_{\text{dis}} H_{\text{Cl}_2(\text{g})}^\circ = 240 \text{ kJ mol}^{-1}.$$

$$\Delta_{\text{eg}} H_{\text{Cl}(\text{g})}^\circ = -350 \text{ kJ mol}^{-1},$$

$$\Delta_{\text{hyd}} H_{\text{Cl}(\text{g})}^\circ = -380 \text{ kJ mol}^{-1}$$

Official Ans. by NTA (610)

Allen Ans. (610)



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

$$= -610 \text{ ans.}$$

54. 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)

Official Ans. by NTA (44)

Allen Ans. (44)

Sol. weight of C in 0.792 gm CO_2

$$= \frac{12}{44} \times 0.792 = 0.216$$

$$\% \text{ of C in compound} = \frac{0.216}{0.492} \times 100$$

$$= 43.90\%$$

Ans : 44

55. 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 : $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$)

Official Ans. by NTA (62250)

Allen Ans. (62250)

Sol. : $\pi = CRT$

$$\frac{400 \text{ Pa}}{10^5} = \frac{2.5 \text{ g}}{M_o} \times 0.83 \frac{\text{L} \cdot \text{bar}}{\text{K} \cdot \text{mol}} \times 300 \text{ K}$$

$$M_o = 62250$$

56. Zinc reacts with hydrochloric acid to give hydrogen and zinc chloride. The volume of hydrogen gas produced at STP from 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 H₂ at STP = 22.7L)

Official Ans. by NTA (4)

Allen Ans. (4)

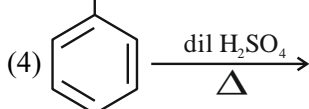
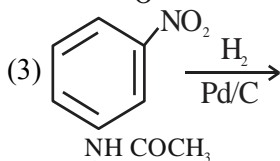
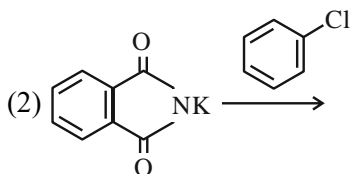
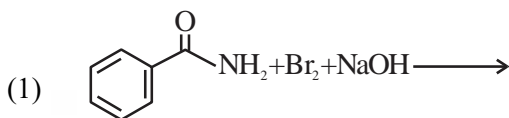


$$\text{Moles of Zn used} = \frac{11.5}{65.4} = \text{Moles of H}_2 \text{ evolved}$$

$$\text{Volume of H}_2 = \frac{11.5}{65.4} \times 22.7L = 3.99L$$

Ans : 4

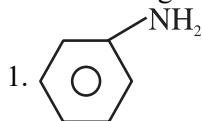
57. How many of the transformation given below would result in aromatic amines?



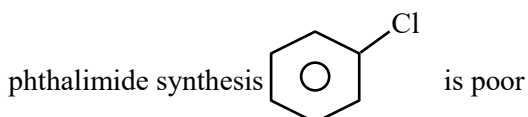
Official Ans. by NTA (3)

Allen Ans. (3)

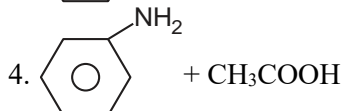
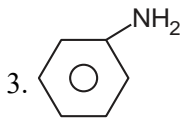
Sol. Product in the given reactions are as follow-



2. No reactions will be observed as in Gabriel



substrate for SN²



Aromatic amines will be formed in 1, 3 & 4

Ans : 3

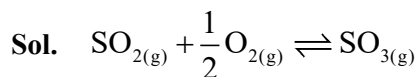
58. For reaction : $SO_2(g) + \frac{1}{2}O_2(g) \rightleftharpoons SO_3(g)$

K_p = 2 × 10¹² at 27°C and 1 atm pressure. The K_c for the same reaction is _____ × 10¹³. (Nearest integer)

(Given R = 0.082 L atm K⁻¹ mol⁻¹)

Official Ans. by NTA (1)

Allen Ans. (1)



$$K_p = 2 \times 10^{12} \text{ at } 300 \text{ K}$$

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

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

$$K_c = 9.92 \times 10^{12}$$

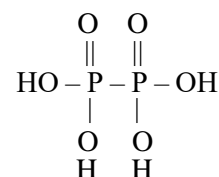
$$K_c = 0.992 \times 10^{13}$$

Ans. 1

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

Official Ans. by NTA (4)

Allen Ans. (4)



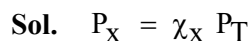
O.S. of P is +4

60. 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)

Official Ans. by NTA (555)

Allen Ans. (555)



$$= \frac{0.6}{\frac{0.6}{20} + \frac{0.45}{45}} \times 740$$

$$P_X = 555 \text{ mm Hg}$$