

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

31.01.2023

CHEMISTRY

SECTION-A

- 31. $Nd^{2+} =$ _____
 - $(1) 4f^26s^2$
- $(2) 4f^4$
- $(3) 4f^3$
- $(4) 4f^46s^2$

Official Ans. by NTA (2)

Allen Ans. (2)

Sol $Nd(60) = [Xe] 4f^4 5d^0 6s^2$

 $Nd^{2+} = [Xe] 4f^4 5d^0 5s^0$

- **32.** 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) 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

Propanal + Methanal =
$$\frac{\text{(i)dil.NaOH}}{\text{(ii)} \land \text{(ii)} \land \text{(ii)} \land \text{(ii)} \land \text{(iii)} \land \text{(iiii)} \land \text{(iiii)} \land \text{(iii)} \land \text{(i$$

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 NaHCO₃ solution
- (4) optically active alcohol and is neutrall

Official Ans. by NTA (3)

Allen Ans. (3)

TEST PAPER WITH SOLUTION

Sol. $CH_3 - CH_2 - CHO + HCHO \xrightarrow{OH^-} \Lambda$

$$CH_{3} \xrightarrow{C} \xrightarrow{C} \xrightarrow{C} \xrightarrow{H_{3}O^{+}} CH_{3} \xrightarrow{C} \xrightarrow{C} \xrightarrow{C} \xrightarrow{H_{3}O^{+}} CH_{2} \xrightarrow{C} CH_{2} CN$$

Carboxylic acid will give CO₂ gas, with NaHCO₃ solution

- **34.** The correct order of basicity of oxides of vanadium is
 - (1) $V_2O_3 > V_2O_4 > V_2O_5$
 - (2) $V_2O_3 > V_2O_5 > V_2O_4$
 - (3) $V_2O_5 > V_2O_4 > V_2O_3$
 - (4) $V_2O_4 > V_2O_3 > V_2O_5$

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 Cu²⁺ 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)
$$X = Cu_2I_2$$

$$Y=Na_2S_4O_6$$

$$(3) X=CuI2$$

$$Y=Na_2S_4O_3$$

$$(4) X=CuI2$$

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.

$$Cu^{2+} + 2KI \longrightarrow CuI_2 \downarrow +2K^+$$
Unstable

I⁻ is strong R.A it reduces Cu²⁺ to Cu⁺

$$2\text{CuI}_2 \longrightarrow \text{Cu}_2\text{I}_2 \downarrow +\text{I}_2$$
(White) 'X'

$$KI + I_2 \longrightarrow K^+I_3^-$$
 (Brown solution)

$$I_3^- \Longrightarrow I_2 + I^-$$

$$KI_3 + Na_2S_2O_3 \rightarrow KI + Na_2S_4O_6$$

36.
$$NO_{2} \xrightarrow{H/Pd} [A] \xrightarrow{(CH_{5}CO)_{2}O} [B]$$

$$(1) \begin{array}{|c|c|} & O & \\ &$$

$$(2) \begin{array}{|c|c|} & O & \\ &$$

Official Ans. by NTA (4) Allen Ans. (4)

(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.

$$\begin{aligned} \text{CoCl}_2 + 6\text{H}_2\text{O} &\longrightarrow & \left[\text{Co(H}_2\text{O)}_6\right]\text{Cl}_2 \\ &\quad \text{Pink(X)} \\ &\quad \text{octahedral} \\ &\quad \downarrow + \text{HCl(conc.)} \\ &\quad \left[\text{CoCl}_4\right]^{2^-} \\ &\quad \text{(Y)Blue solution} \\ &\quad \text{(Z)Tetrahedral} \end{aligned}$$

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

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

- (1) $X=ClONO_2$, Y=HOCl, $Z=NO_2$
- (2) X=ClNO₂, Y=HCl, Z=HNO₃
- (3) X=ClONO₂, Y=HOCl, Z=HNO₃
- (4) $X=CINO_3$, $Y=Cl_2$, $Z=NO_2$

Official Ans. by NTA (3)

Allen Ans. (3)

 $ClO + NO_2 \longrightarrow ClO NO_2 \xrightarrow{+H_2O} HOCl + HNO_3$ Sol.

39. The correct order of melting point of dichlorobenzenes is

$$(1) \bigcup_{Cl}^{Cl} > \bigcup_{Cl}^{Cl} > \bigcup_{Cl}^{Cl}$$

$$(2) \begin{array}{c} Cl \\ Cl \\ > Cl \\ Cl \\ > Cl \\ \\ Cl \\ \end{array}$$

$$(3) \begin{array}{c} CI \\ > \\ CI \end{array} \begin{array}{c} CI \\ > \\ \end{array} \begin{array}{c} CI \\ > \\ \end{array} \begin{array}{c} CI \\ > \\ \end{array}$$

$$(4) \bigcirc CI \bigcirc CI \bigcirc CI \bigcirc CI$$

$$CI \bigcirc CI \bigcirc CI$$

$$CI \bigcirc CI \bigcirc CI$$

$$CI \bigcirc CI$$

$$CI \bigcirc CI$$

Official Ans. by NTA (4) Allen Ans. (4)

Sol.

M.P a Packing efficiency

$$Cl$$
 Cl
 $\Rightarrow \mu_{max}$

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

$$\begin{array}{c} \operatorname{CH_3} \\ | \\ (2) \ \operatorname{CH_3} - \operatorname{CH} - \operatorname{CH_2} - \operatorname{CH} - \operatorname{COOH} \\ | \\ \operatorname{NH_2} \end{array}$$

(4)
$$CH_3 - C - CH_2 - CH_2COOH$$

 NH_2

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:

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

Given
$$\lambda(H) = \lambda(He^+)$$

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

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. H ₂ O/CH ₂ Cl ₂	i. Crystallization
B. OH NO ₂	ii. Differential solvent extraction
C. Kerosene/Naphthalene	iii. Column chromatography
D. C ₆ H ₁₂ O ₆ /NaCl	iv. Fractional Distillation

Correct match is:

Official Ans. by NTA (3)

Allen Ans. (3)

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

В.

$$\begin{array}{c|c} O & OH \\ \hline O & iii. \ column \\ \hline NO_2 & iii. \end{array}$$

Due to H-bonding in \bigcirc it can be separated NO,

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.

43. The correct increasing order of the ionic radii is

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

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

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

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

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

Z: 20 19

- 17 18
- 44. H_2O_2 acts as a reducing agent in

$$(1) 2NaOCl + H2O2 \rightarrow 2NaCl + H2O + O2$$

(2)
$$2Fe^{2+} + 2H^{+} + H_{2}O_{2} \rightarrow 2Fe^{3+} + 2H_{2}O$$

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. NaOCl +
$$H_2O_2$$
 \longrightarrow 2NaCl + H_2O + O_2 (-1)

- **45.** Which of the following artificial sweeteners has the highest sweetness value in comparison to cane sugar?
 - (1) Aspartame
 - (2) Sucralose
 - (3) Alitame
 - (4) Saccharin

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Sweetness value order wrt cane sugar

Alitame > Sucralose > Saccharin > Aspartame

46. 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

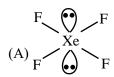
Choose the correct answer from the options given below:

- (1) A-IV, B-III, C-II, D-I
- (2) A-II, B-I, C-III, D-IV
- (3) A-IV, B-I, C-II, D-III
- (4) A-II, B-I, C-IV, D-III

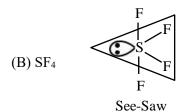
Official Ans. by NTA (4)

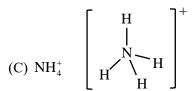
Allen Ans. (4)

Sol.



Square planer





Tetrahedral

(D) Br
$$F_3$$
 F

$$F$$

$$F$$
Bent T- Shaped

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

trans (Ph-CH=CH–CH₃) → cis (Ph-CH=CH–CH₃)

- (1) Br₂, alc KOH, NaNH₂, Na(Liq NH₃)
- (2) Br₂, alc KOH, NaNH₂, H₂Lindlar Catalyst
- (3) Br₂, aq KOH, NaNH₂, H₂Lindlar Catalyst
- (4) Br₂, aq KOH, NaNH₂, Na(Liq NH₃)

Official Ans. by NTA (2) Allen Ans. (2)

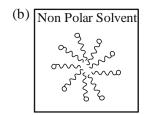
Sol.

$$Ph \longrightarrow C = C \xrightarrow{H} \xrightarrow{Br_2} Ph-CH-CH-CH_3$$

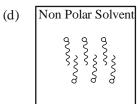
$$Ph \longrightarrow C = C \xrightarrow{CH_3} \underbrace{\frac{H_2}{\text{Lindlar's}}}_{\text{Catalyst}} Ph - C \equiv C - CH_3$$

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

(a) Non Polar Solvent



(c) Non Polar Solvent



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

Official Ans. by NTA (3)

Allen Ans. (3)

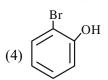
Sol. Non-Polar tail towards non-polar solvent **Ans. 3**

49. An organic compound 'A' with empirical formula C₆H₆O gives sooty flame on burning. Its reaction with bromine solution in low polarity solvent results in high yield of B. B is

(1) OH
Br

(2) CH₂CH₂Br

(3) Br CH₂CH₃



Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Aromatic compounds burns with sooty flame

$$\begin{array}{c}
OH \\
O \\
Place{OH}
Place{OH}$$

- **50.** Which one of the following statements is correct for electrolysis of brine solution?
 - (1) Cl₂ is formed at cathode
 - (2) O₂ is formed at cathode
 - (3) H₂ is formed at anode
 - (4) OH⁻ is formed at cathode

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Electrolysis of brine solution

 $NaCl(aq.) \longrightarrow Na_{(aq)}^+ + Cl_{(aq)}^+$

At anode: $2Cl_{(aq.)}^+ \longrightarrow Cl_2(g) + 2e^{-g}$

 $2H_2O_{(\ell)} \longrightarrow O_{2(g)} + 4H_{(aq)}^+ + 4e^-$

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

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

SECTION-B

The logarithm of equilibrium constant for the 51. reaction $Pd^{2+} + 4Cl^{-} \rightleftharpoons PdCl_{4}^{2-}$

(Nearest integer)

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

$$Pd_{(ag)}^{2+} + 2e^{-} \rightleftharpoons Pd(s)$$
 $E^{\circ} = 0.83V$

$$PdCl_4^{2-}(aq) + 2e^- \rightleftharpoons Pd(s) + 4Cl^-(aq)$$

$$E^{\circ} = 0.65V$$

Official Ans. by NTA (6)

Allen Ans. (6)

Sol.
$$\Delta G^{\circ} = -RT\ell n K$$

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

$$\frac{E_{Cell}^{o}}{0.06} \times n = \log K \qquad ...(1)$$

$$Pd^{+2}(aq.) + 2e^{-} \Longrightarrow Pd(s)$$
, $E^{o}_{cat,red^{n}} = 0.83$

$$Pd(s) + 4Cl^{-}(aq.) \rightleftharpoons PdCl_{4}^{2-}, (aq) + 2e^{-}, E_{analo Civila}^{o} = 0.65$$

Net Reaction \rightarrow Pd²⁺ (aq.) + 4Cl⁻(aq.) \rightleftharpoons PdCl₄²⁻(aq.)

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

$$E_{cell}^{o} = 0.83 - 0.65$$

$$E_{cell}^{o} = 0.18$$
 ...(2)

Also
$$n = 2$$
 ...(3)

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

logK = 6

$A \rightarrow B$ **52.**

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 : In 10 = 2.3

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

$$log5 = 0.70$$

$$\log 3 = 0.48$$

$$log2 = 0.30$$

Official Ans. by NTA (2520)

 $E_a = 2519.88 J \Rightarrow E_a = 2520 J$

Allen Ans. (2520)

Sol.

$$\begin{split} \log \frac{K_{300}}{K_{200}} &= \frac{E_a}{2.3 \times 8.314} \left(\frac{1}{T_1} - \frac{1}{T_2} \right) \\ \log \frac{0.05}{0.03} &= \frac{Ea}{2.305 \times 8.314} \times \left[\frac{1}{200} - \frac{1}{300} \right] \end{split}$$

$$\frac{1}{2}$$
Cl₂(g) to Cl⁻ (aq) is (-) _____

kJ mol⁻¹ (Nearest integer)

Given: $\Delta_{\text{dis}} H_{\text{Cl}_{2(c)}}^{\text{o}} = 240 \text{ kJmol}^{-1}$.

$$\Delta_{\rm eg} H_{\rm Cl_{(g)}}^{\rm o} = -350 \,{\rm kJmol}^{-1},$$

$$\Delta_{hyd} H_{Cl_{(a)}^{-}}^{o} = -380 \text{kJmol}^{-1}$$

Official Ans. by NTA (610)

Allen Ans. (610)

Sol.
$$\frac{1}{2}Cl_{2(g)} \to Cl_{(g)} \to Cl_{(g)}^- \to Cl_{(aq.)}^-$$

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

= -610 ans.

54. On complete combustion, 0.492 g of an organic compound gave 0.792 g of CO₂.

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 CO₂

$$=\frac{12}{44}\times0.792=0.216$$

% 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 : $R = 0.083 L bar K^{-1} mol^{-1}$)

Official Ans. by NTA (62250) Allen Ans. (62250)

Sol. :
$$\pi = CRT$$
 2.5g

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

$$M_o = 62250$$

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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 $65.4g \text{ mol}^{-1}$ and Molar volume of H_2 at STP = 22.7L)

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. $\operatorname{Zn} + 2\operatorname{HCl} \rightarrow \operatorname{ZnCl}_2 + \operatorname{H}_2 \uparrow$

Moles of Zn used = $\frac{11.5}{65.4}$ = Moles of H₂ evolved

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?

(1)
$$O$$
 NH_2+Br_2+NaOH

$$(2) \underbrace{ \bigcap_{NK}^{O} NK}_{NK} \underbrace{ \bigcap_{NK}^{Cl} NK}_{NK}$$

$$(3) \overbrace{\frac{H_2}{Pd/C}}^{NO_2}$$

(4) $\frac{\text{NH COCH}_{3}}{\Delta}$

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

phthalimide synthesis O is poor

substrate for SN²

Aromatic amines will he formed in 1, 3 & 4

Ans: 3

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

 $K_P = 2 \times 10^{12}$ at 27°C and 1 atm pressure. The K_c for the same reaction is _____ \times 10¹³. (Nearest integer)

(Given $R = 0.082 L atm K^{-1} mol^{-1}$)

Official Ans. by NTA (1)

Allen Ans. (1)

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

 $K_p = 2 \times 10^{12}$ at 300 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 sate of phosphorus in hypophosphoric acid is + _____.

Official Ans. by NTA (4) Allen Ans. (4)

Sol. $H_4P_2O_6$

$$\begin{array}{c|c} O & O \\ \parallel & \parallel \\ HO - P - P - OH \\ \mid & \mid \\ O & O \\ H & H \end{array}$$

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)

Sol. $P_X = \chi_X P_T$

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

 $P_x = 555 \text{ mm Hg}$