Nishant Jindal

REDOX

2. In polythionic acid, $H_2S_xO_6$(x = 3 to 5) the oxidation state(s) of Sulphur is/are :

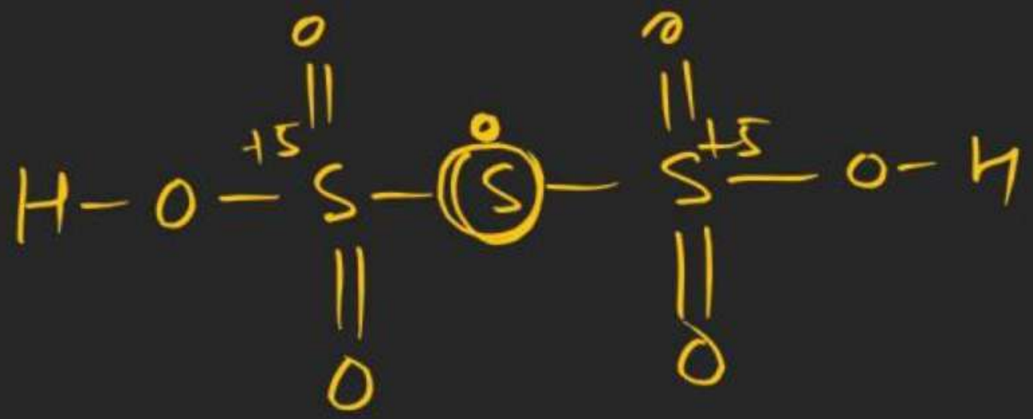
[JEE Main, August 2021]

(A) + 5 only

(B) + 6 only

(C) + 3 and + 5 only

(D) 0 and + 5 only



Nishant Jindal

REDOX

3. Which one of the following reactions indicates the reducing ability of hydrogen peroxide in basic medium ?

[JEE Main, June 2022]

(A) $HOCl + H_2O_2 \rightarrow H_3O^+ + Cl^- + O_2$

(B) $PbS + 4H_2O_2 \rightarrow PbSO_4 + 4H_2O$

(C) $2MnO_4^- + 3H_2O_2 \rightarrow 2MnO_2 + 3O_2 + 2H_2O + 2OH^-$

(D) $Mn^{2+} + H_2O_2 \rightarrow Mn^{4+} + 2OH^-$

Nishant Jindal

REDOX

4. In neutral or faintly alkaline medium, $KMnO_4$ being a powerful oxidant can oxidize, thiosulphate almost quantitatively, to sulphate. In this reaction overall change in oxidation state of manganese will be: [JEE Main, July 2022]

(A) 5 (B) 1 (C) 0 (D) 3

Nishant Jindal

REDOX

1. The oxidation states of 'P' in $H_4P_2O_7$, $H_4P_2O_5$ and $H_4P_2O_6$, respectively, are:

(A) 7, 5 and 6 (B) 5, 4 and 3 (C) 5, 3 and 4 (D) 6, 4 and 5

[JEE Main, July 2021]

Nishant Jindal

REDOX

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[JEE Main, August 2021]

(A) + 5 only

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(C) + 3 and + 5 only

(D) 0 and + 5 only

Nishant Jindal

REDOX

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Nishant Jindal

REDOX

4. In neutral or faintly alkaline medium, $KMnO_4$ being a powerful oxidant can oxidize, thiosulphate almost quantitatively, to sulphate. In this reaction overall change in oxidation state of manganese will be: [JEE Main, July 2022]

(A) 5 (B) 1 (C) 0 (D) 3

Nishant Jindal

REDOX

5. The reaction of sulphur in alkaline medium is the below: [JEE Main, Feb 2021]

$$S_{8(s)} + aOH^-_{(aq)} \rightarrow bS^{2-}_{(aq)} + cS_2O_3^{2-}{}_{(aq)} + dH_2O_{(\ell)}$$

The values of 'a' is _____. (Integer answer)

Nishant Jindal

IONIC EQUILIBRIUM

2. Given below are two statements: one is labelled as Assertion A and the other is labelled as Reason R. [JEE Main, July 2022]

(T) Assertion (A): Phenolphthalein is a pH dependent indicator, remains colourless in acidic solution and gives pink colour in basic medium

Reason (R): Phenolphthalein is a weak acid. It doesn't dissociate in basic medium. (F)

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

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and Rare true but R is NOT the correct I explanation of A.

(3) A is true but R is false

(4) A is false but R is true

Colourless 8.3 — 10 Pink

Pinkish Red → yellow

Red → yellow

Nishant Jindal

REDOX

6. The volume (in mL) of 0.1 N NaOH required to neutralise 10 mL of 0.1 N phosphinic acid is _____. [Given 10.00]

[Jee Main, 2020]

$H_3PO_4 \longrightarrow$

$H_3PO_3 \longrightarrow$

$\longrightarrow H_3PO_2 \longrightarrow$

$(n_f = 1)$

REDOX

7. The normality of H_2SO_4 in the solution obtained on mixing 100 mL of 0.1 M H_2SO_4 with 50 mL of 0.1 M NaOH is _____ $\times 10^{-1}$ N. (Nearest Integer)

[JEE Main, July 2022]

Nishant Jindal

REDOX

8. 10.0 mL of 0.05 M $KMnO_4$ solution was consumed in a titration with 10.0 mL of given oxalic acid dihydrate solution. The strength of given oxalic acid solution is_____$\times 10^{-2}$ g/L. (Round off to the nearest integer) [JEE Main, July 2021]

$$KMnO_4 + H_2C_2O_4 \cdot 2H_2O \longrightarrow CO_2 + Mn^{2+}$$

$(n_f = 5)$ $(n_f = 2)$

REDOX

9. In basics medium CrO_4^{2-} oxidises $S_2O_3^{2-}$ to form SO_4^{2-} and itself changes into $Cr(OH)_4^-$. The volume of 0.154M CrO_4^{2-} required to react with 40 mL of 0.25M $S_2O_3^{2-}$ is ___mL. (Rounded-off to the nearest integer) [JEE Main, Feb 2021]

Nishant Jindal

REDOX

10. The volume, in mL, of 0.02 M $K_2Cr_2O_7$ solution required to react with 0.288 g of ferrous oxalate in acidic medium is _____ .

(Molar mass of Fe = 56 g mol^{-1})

[Jee Main, 2020]

$FeC_2O_4 \longrightarrow Fe^{3+} + CO_2$

($n_f = 3$)

Nishant Jindal

$$P_T = X_A P_A^0 + X_B P_B^0$$

$$y_A P_T = X_A P_A^0$$

$$y_B P_T = X_B P_B^0$$

$$\frac{1}{P_T} = \frac{y_A}{P_A^0} + \frac{y_B}{P_B^0}$$

$$P = K_H x$$

$$\frac{P_0 - P_s}{P_0} = x_{solute} = \frac{n}{n+N}$$

$$\frac{P_0 - P_s}{P_s} = m \times \frac{M_{solvent}}{1000}$$

$$\Delta T_b = K_b \times m \times i$$

$$\Delta T_f = K_f \times m \times i$$

$$\pi = CRT \times i$$

$$i = 1 + (n-1)\alpha$$

Nishant Jindal

Liquid Solution

1. Liquid 'M' and liquid 'N' form an ideal solution. The vapour pressures of pure liquids 'M' and 'N' are 450 and 700 mmHg, respectively, at the same temperature. Then correct statement is :

(x_M = Mole fraction of 'M' in solution;
x_N = Mole fraction of 'N' in solution;
y_M = Mole fraction of 'M' in vapour phase;
y_N = Mole fraction of 'N' in vapour phase)

$y_N > x_N$ $\quad \frac{y_N}{x_N} > 1$

$y_M < x_M$ $\quad \frac{y_M}{x_M} < 1$

[Jee Main, April 2019]

(1) $\frac{x_M}{x_N} > \frac{y_M}{y_N}$ $\quad$ (2) $(x_M - y_M) < (x_N - y_N)$

(3) $\frac{x_M}{x_N} < \frac{y_M}{y_N}$ $\quad$ (4) $\frac{x_M}{x_N} = \frac{y_M}{y_N}$

Nishant Jindal

Liquid Solution

2. A set of solutions is prepared using 180 g of water as a solvent and 10 g of different non-volatile solutes A, B and C. The relative lowering of vapour pressure in the presence of these solutes are in the order [Given, molar mass of A = 100 g mol^{-1}; B = 200 g mol^{-1} ; C = 10,000 g mol^{-1}]

(1) A > B > C

(2) A > C > B

(3) C > B > A

(4) B > C > A

[Jee Main, 2020]

Liquid Solution

3. Solute A associates in water. When 0.7 g of solute A is dissolved in 42.0 g of water, it depresses the freezing point by 0.2°C. The percentage association of solute A in water, is

[Given : Molar mass of A = 93 g mol^{-1}. Molal depression constant of water is 1.86 K kg mol^{-1}]

[JEE Main, June 2022]

(1) 50 %

(2) 60 %

(3) 70 %

(4) 80 %

$$\Delta T_f = K_f \times m \times \left[1 + \left(\frac{1}{n} - 1\right)\alpha\right]$$

$$= 1.86 \times \frac{0.7/93}{42} \times 1000 \left[1 + \left(\frac{1}{2} - 1\right)\alpha\right]$$

Nishant Jindal

Liquid Solution

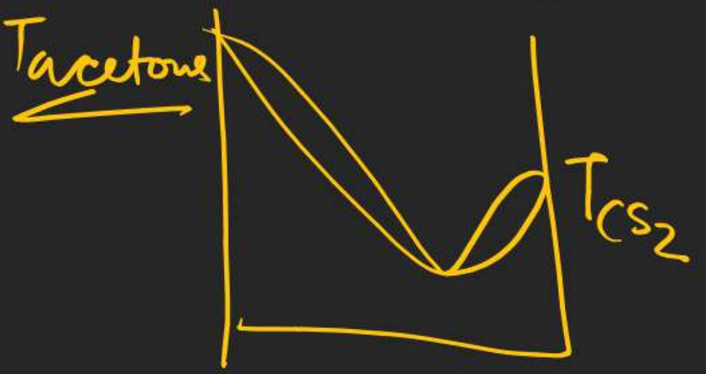
4. At 35°C, the vapour pressure of CS_2 is 512 mm Hg and that of acetone is 344 mm Hg. A solution of CS_2 in acetone has a total vapour pressure of 600 mm Hg. The false statement amongst the following is:

(1) CS_2 and acetone are less attracted to each other than to themselves T

(2) a mixture of 100 mL CS_2 and 100 mL acetone has a volume < 200 mL F

(3) Raoult's law is not obeyed by this system T

(4) heat must be absorbed in order to produce the solution at 35°C T



[Jee Main, 2020]

Nishant Jindal

Liquid Solution

α β γ δ

5. Henry's constant (in kbar) for four gases a, b, g and d in water at 298 K is given below : [Jee Main, 2020]

	α	β	γ	δ
K_H	50	2	2×10^{-5}	0.5

(Density of water = 10^3kg m^{-3} at 298 K) This table implies that :

(1) a has the highest solubility in water at a given pressure

(2) The pressure of a 55.5 molal solution at g is 250 bar

(3) Solubility of g at 308 K is lower than at 298 K

(4) The pressure of a 55.5 molal solution of g is 1 bar

$P = K_H \times x$

$250 \text{ bar} = 0.5 \times 10^3 \times x$

$x = \frac{500}{1000} = 0.5$

$\frac{0.5}{9 \times 2} \times 1000$

0.5 g gm

0.5

Nishant Jindal

Liquid Solution

6. The vapour pressures of two volatile liquids A and B at 25°C are 50 Torr and 100 Torr, respectively. If the liquid mixture contains 0.3 mole fraction of A, then the mole fraction of liquid B in the vapour phase is $\frac{x}{17}$. The value of x is_____.

[JEE Main, June 2022]

$y_A = ?$

Nishant Jindal

Liquid Solution

7. The elevation in boiling point for 1 molal solution of non-volatile solute A is 3K. The depression in freezing point for 2 molal solution of A in the same solvent is 6 K. The ratio of K_b and K_f i.e., K_b/K_f is 1 : X. The value of X is [nearest integer]

[JEE Main, July 2022]

$$\frac{\Delta T_b}{\Delta T_f} = \frac{K_b \times m}{K_f \times m}$$

Nishant Jindal

Liquid Solution

8. A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be_____.

[Jee Main, 2020]

(Given, K_f (water) = 2.0 K kg mol^{-1}, R = 0.08 dm^3 atm K^{-1} mol^{-1})

$\Delta T_f = 2 \times 0.5 = 1$

$T_f = 272k$

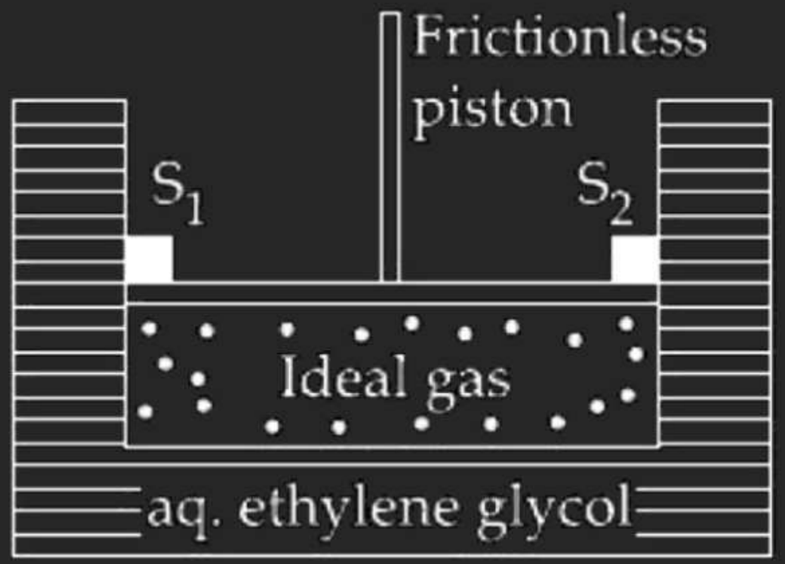
Nishant Jindal

Liquid Solution

8. A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be_____.

[Jee Main, 2020]

(Given, K_f (water) = 2.0 K kg mol^{-1}, R = 0.08 dm^3 atm K^{-1} mol^{-1})



$P = 1 atm$

$PXV = nRT$

Nishant Jindal

Liquid Solution

9. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient instantaneously, it has to be isotonic with blood. The concentration of glucose solution in gmL^{-1} is _____(Molar mass of glucose = 180 g mol^{-1} R = 0.083 L bar K^{-1} mol^{-1}) (Nearest integer) [JEE Main, June 2022]

$7.47 = C \times 0.083 \times 300$

Nishant Jindal

Liquid Solution

10. In a solvent 50% of an acid HA dimerizes and the rest dissociates. The Van't Hoff factor of the acid is _____ $\times 10^{-2}$. (Round off to the nearest integer).

[JEE Main, July 2021]

1 mol

actual moles $= \frac{1}{2} + 1 = 1.5$

$i = \frac{1.5}{1} = 1.5 = 150 \times 10^{-2}$

Nishant Jindal

Liquid Solution

11. Of the following four aqueous solutions, total number of those solutions whose freezing point is lower than that of 0.10 M C_2H_5OH is _____. (Integer answer)

[JEE Main, August 2021]

(i) 0.10 M $Ba_3(PO_4)_2$

(ii) 0.10 M Na_2SO_4

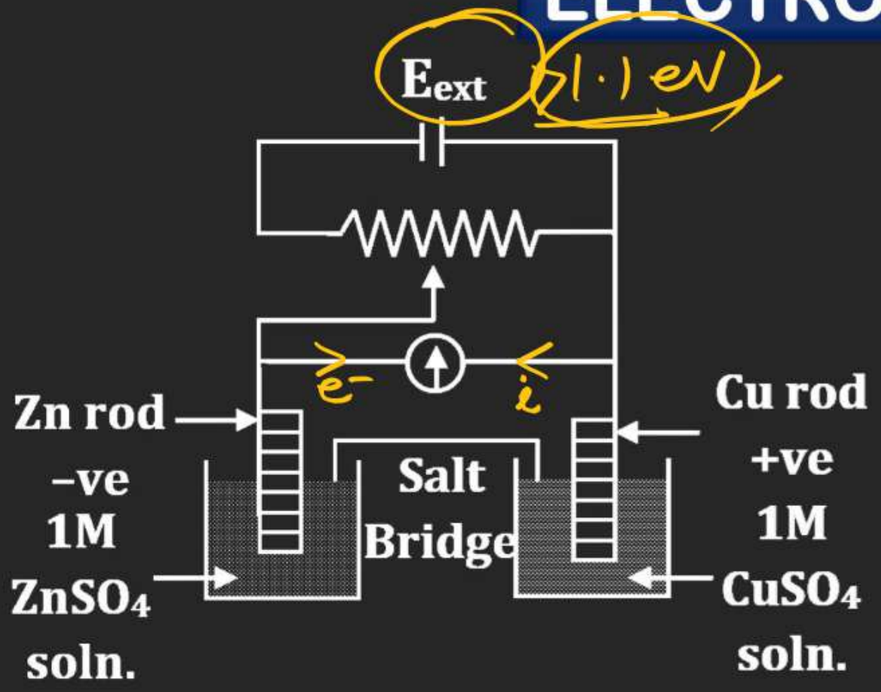
(iii) 0.10 M KCl

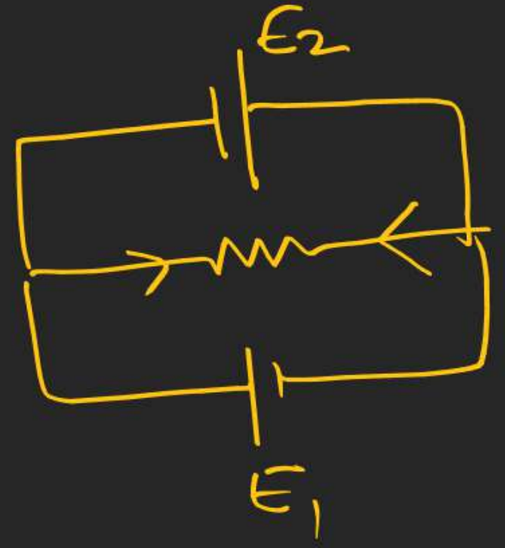
(iv) 0.10 M Li_3PO_4

Nishant Jindal

ELECTROCHEMISTRY

1.





$E^{\circ}_{Cu^{2+}|Cu} = +0.34V$

$E^{\circ}_{Zn^{2+}|Zn} = 0.76V$

1.1

[Jee Main, April 2019]

Identify the incorrect statement from the options below for the above cell :

(1) If E_{ext} > 1.1 V, e^- flows from Cu to Zn

(2) If E_{ext} > 1.1 V, Zn dissolves at Zn electrode and Cu deposits at Cu electrode

(3) If E_{ext} < 1.1 V, Zn dissolves at anode and Cu deposits at cathode

(4) If E_{ext} = 1.1 V, no flow of e^- or current occurs

Nishant Jindal

ELECTROCHEMISTRY

2. Calculate the standard cell potential (in V) of the cell in which following reaction takes place :

$Fe^{2+}(aq) + Ag^{+}(aq) \rightarrow Fe^{3+}(aq) + Ag(s)$ (n = 1)

Given that

[Jee Main, April 2019]

$E^{\circ}_{Ag^{+}/Ag} = x\ V$

$E^{\circ}_{Fe^{2+}/Fe} = y\ V$

$E^{\circ}_{Fe^{3+}/Fe} = z\ V$

(1) x – z

(2) x + 2y – 3z

(3) x – y

(4) x + y – z

Nishant Jindal

ELECTROCHEMISTRY

3. Consider the following reduction processes :

$Zn^{2+} + 2e^- \rightarrow Zn(s)$; $E^\circ = -0.76$ V

$Ca^{2+} + 2e^- \rightarrow Ca(s)$; $E^\circ = -2.87$ V

$Mg^{2+} + 2e^- \rightarrow Mg(s)$; $E^\circ = -2.36$ V

$Ni^{2+} + 2e^- \rightarrow Ni(s)$; $E^\circ = -0.25$ V

0.76 2.87 2.36 0.25

The reducing power of the metals increases in the order : [Jee Main, Jan 2019]

(1) Ca < Mg < Zn < Ni

(2) Zn < Mg < Ni < Ca

(3) Ni < Zn < Mg < Ca

(4) Ca < Zn < Mg < Ni

Nishant Jindal

ELECTROCHEMISTRY

4. The standard electrode potential E^{Θ} and its temperature coefficient $\left(\frac{dE^{\Theta}}{dT}\right)$ for a cell are 2V and -5×10^{-4} VK^{-1} at 300 K respectively. The cell reaction is Zn(s) + Cu^{2+} (aq) $\rightarrow$ Zn^{2+} (aq) + Cu(s) The standard reaction enthalpy $\left(\Delta_r H^{\Theta}\right)$ at 300 K in kJ mol^{-1} is,

[Use R = 8 JK^{-1} mol^{-1} and F = 96,000 C mol^{-1}]

(1) 192.0 (2) –384.0 (3) 206.4 (4) –412.8

[Jee Main, Jan 2019]

$$nF\left(\frac{dE}{dT}\right) = \Delta S$$

$$\Delta G = \Delta H - T\Delta S$$

$$-nFE^{\circ} = \Delta H - nFT\left(\frac{dE}{dT}\right)$$

ELECTROCHEMISTRY

5. Given below are two statements: One is labelled as Assertion A and the other is labelled as Reason R

Assertion (A): Permanganate titrations are not performed in presence of hydrochloric acid.

Reason (R): Chlorine is formed as a consequence of oxidation of hydrochloric acid.

In the light of the above statements, choose the correct answer from the options given below [JEE Main, July 2022]

(1) Both A and R are true and R is the correct explanation of A

(2) Both A and Rare true but R is NOT the correct explanation of A

(3) A is true but R is false

(4) A is false but R is true

$HCl \rightarrow Cl_2$

Nishant Jindal

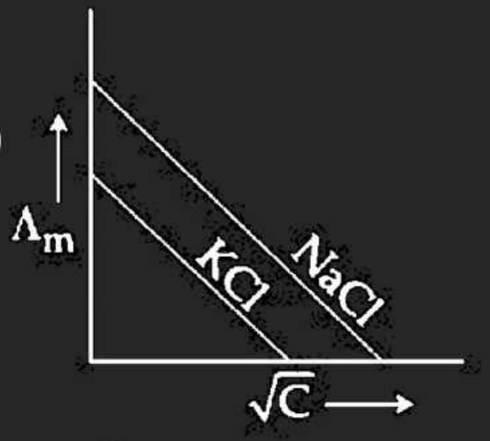
ELECTROCHEMISTRY

6. Which one of the following graphs between molar conductivity (Λ_m) versus $\sqrt{C}$ is correct ?

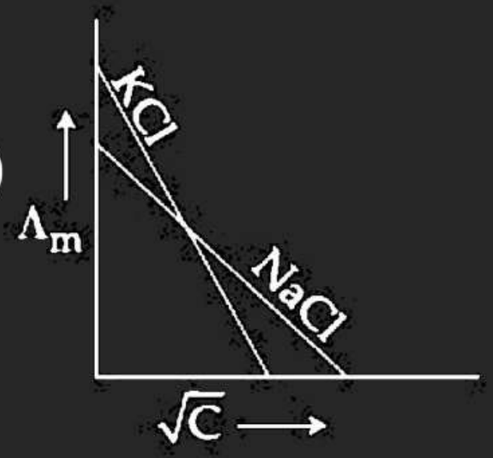
[Jee Main, April 2019]

$Na^+ < K^+$

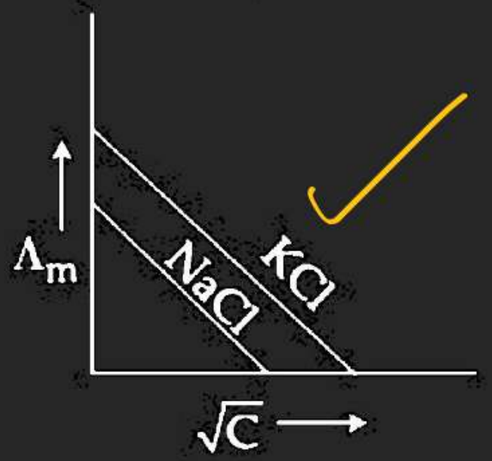
(A)



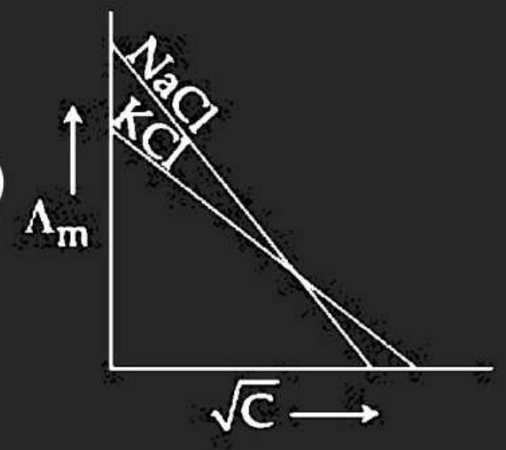
(B)



(C)



(D)



Nishant Jindal

ELECTROCHEMISTRY

7. For the disproportionation reaction $2Cu^{+}(aq) \rightarrow Cu(s) + Cu^{2+}(aq)$ at 298 K, ln K (where k is the equilibrium constant) is _____ $\times 10^{-1}$.

Given : $(E^{0}_{Cu^{2+}/Cu^{+}} = 0.16V E^{0}_{Cu^{+}/Cu} = 0.52V \frac{RT}{F} = 0.025)$

[Jee Main, 2020]

Nishant Jindal

ELECTROCHEMISTRY

8. The magnitude of the change in oxidising power of the MnO_4^-/Mn^{2+} couple is x $\times$ 10^{-4} V, if the H^+ concentration is decreased from 1 M to 10^{-4} M at 25°C. (Assume concentration of MnO_4^- and Mn^{2+} to be same on change in H^+ concentration). The value of x is _____. (Rounded off to the nearest integer)

$\left[\text{Given: } \frac{2.303RT}{F} = 0.059\right]$

[JEE Main, Feb 2021]

$$5e^- + 8H^+ + MnO_4^- \longrightarrow Mn^{2+} + 4H_2O$$

$$E^- = E^\circ - \frac{0.059}{5} \log \frac{1}{(10^{-4})^8}$$

ELECTROCHEMISTRY

9. For an electrochemical cell

$Sn(s)|Sn^{2+}(aq, 1M)||Pb^{2+}(aq, 1M)|Pb(s)$

the ratio $\frac{[Sn^{2+}]}{[Pb^{2+}]}$ when this cell attains equilibrium is _____.

$\left(\text{Given: } E^0_{Sn^{2+}|Sn} = -0.14V, E^0_{Pb^{2+}|Pb} = -0.13V, \frac{2.303RT}{F} = 0.06\right)$ [Jee Main, 2020]

ELECTROCHEMISTRY

10. The cell potential for the given cell at 298 K

Pt | H_2(g,1 bar) | H^+(aq) || Cu^{2+}(aq) | Cu(s)

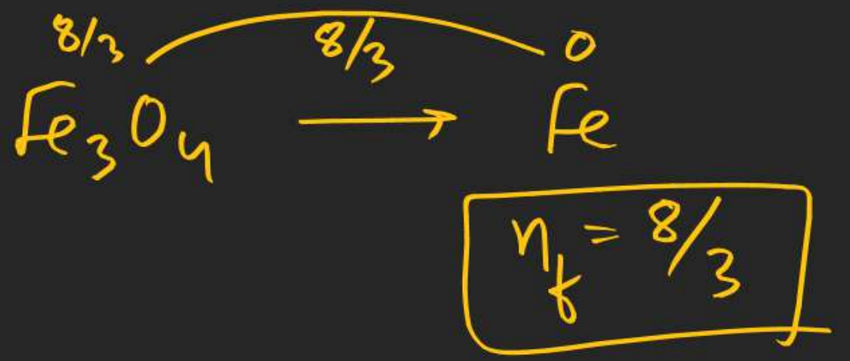
is 0.31V. The pH of the acidic solution is found to be 3, whereas the concentration of Cu^{2+} is 10^{-x} M. The value of x is _____.

(Given: $E^{\Theta}_{Cu^{2+}/Cu} = 0.34V$ and $\frac{2.303RT}{F} = 0.06V$) [JEE Main, June 2022]

Nishant Jindal

ELECTROCHEMISTRY

11. The amount of change in F (Faraday) required to obtain one mole of iron from Fe_3O_4 is_____ . (Nearest Integer) [JEE Main, July 2022]



Nishant Jindal

ELECTROCHEMISTRY

12. A KCl solution of conductivity 0.14 S m^{-1} shows a resistance of 4.19 Ω in a conductivity cell. If the same cell is filled with an HCl solution, the resistance drops to 1.03 Ω. The conductivity of the HCl solution is ____ $\times 10^{-2}$ S m^{-1}.
(Round off to the Nearest Integer)

[JEE Main, March 2021]

$$0.14 = \frac{1}{4.19} \times \frac{\ell}{A}$$

$$K = \frac{1}{1.03} \times \ell/A$$

ELECTROCHEMISTRY

13. The solubility product of a sparingly soluble salt A_2X_3 is 1.1×10^{-23}. If specific conductance of the solution is 3×10^{-5} S m^{-1}, the limiting molar conductivity of the solution is $x \times 10^{-3}$ S m^2 mol^{-1}.

The value of x is _____.

[JEE Main, June 2022]

$$\Lambda_m^\infty = \frac{k}{\text{conc} \times S}$$