Q1 JEE Main 2020 - 2 September (Morning)

The Gibbs energy change (in J) for the given reaction at $\left[\mathrm{Cu}^{2+}\right]=\left[\mathrm{Sn}^{2+}\right]=1 \mathrm{M}$ and $298 \mathrm{K}$ is:

$\mathrm{Cu}(\mathrm{s})+\mathrm{Sn}^{2+}(\mathrm{aq.}) \rightarrow \mathrm{Cu}^{2+}(\mathrm{aq.})+\mathrm{Sn}(\mathrm{s})$

$\left(\mathrm{E}^{0}_{\mathrm{Sn}^{2+}}=-0.16 \mathrm{V}, \mathrm{E}^{0}_{\mathrm{Cu}^{2+} \mid \mathrm{Cu}}=0.34 \mathrm{V}\right.$

$\left.\text{Take } \mathrm{F}=96500 \mathrm{C} \mathrm{mol}^{-1}\right)$

Q2 JEE Main 2020 - 2 September (Evening)

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

Given:

$\left(\mathrm{E}^{0}_{\mathrm{Cu}^{2+} / \mathrm{Cu}^{+}}=0.16 \mathrm{V}\right.$

$\mathrm{E}^{0}_{\mathrm{Cu}^{+} / \mathrm{Cu}}=0.52 \mathrm{V}$

$\left.\frac{R T}{F}=0.025\right)$

Q3 JEE Main 2020 - 3 September (Morning)

Let $\mathrm{C}_{\mathrm{NaCl}}$ and $\mathrm{C}_{\mathrm{BaSO}_4}$ be the conductances (in S) measured for saturated aqueous solutions of NaCl and BaSO_4, respectively, at a temperature T.

Which of the following is false?

(A) $\mathrm{C}_{\mathrm{BaSO}_4}\left(\mathrm{T}_2\right)>\mathrm{C}_{\mathrm{BaSO}_4}\left(\mathrm{T}_1\right)$ for $\mathrm{T}_2>\mathrm{T}_1$

(B) $\mathrm{C}_{\mathrm{NaCl}}\left(\mathrm{T}_2\right)>\mathrm{C}_{\mathrm{NaCl}}\left(\mathrm{T}_1\right)$ for $\mathrm{T}_2>\mathrm{T}_1$

(C) $\mathrm{C}_{\mathrm{NaCl}} \gg \mathrm{C}_{\mathrm{BaSO}_4}$ at a given T

(D) Ionic mobilities of ions from both salts increase with T.

Q4 JEE Main 2020 - 3 September (Morning)

The photoelectric current from Na (work function, $w_0=2.3 \mathrm{eV}$) is stopped by the output voltage of the cell

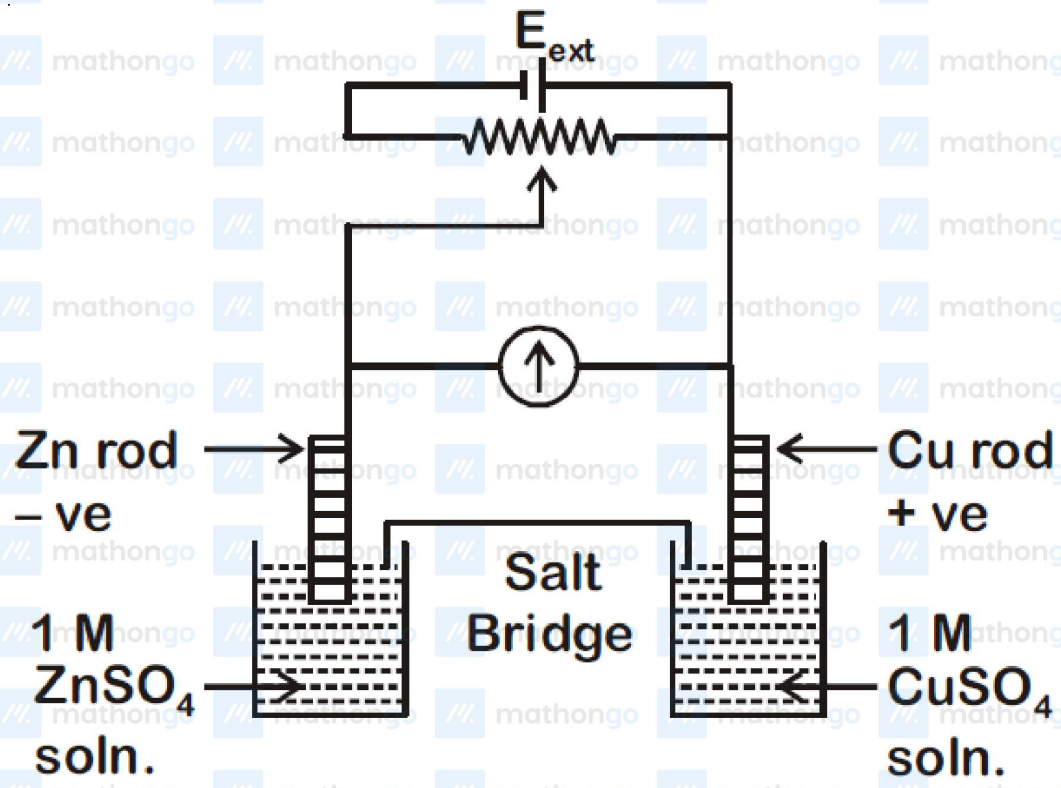
$\mathrm{Pt}(\mathrm{s})\left|\mathrm{H}_2(\mathrm{g}, 1 \mathrm{bar})\right| \mathrm{HCl}(\mathrm{aq} \cdot, \mathrm{pH}=1)|\mathrm{AgCl}(\mathrm{s})|\mathrm{Ag}(\mathrm{s})$

The pH of aq. HCl required to stop the photoelectric current from K $(w_0 = 2.25eV)$, all other conditions remaining the same, is $\times 10^{-2}$ (to the nearest integer).
Given, $2.303\frac{RT}{F} = 0.06V; E^0_{AgClAglCC^-} = 0.22V$

Q5 JEE Main 2020 - 3 September (Evening)

An acidic solution of dichromate is electrolyzed for 8 minutes using 2 A current. As per the following equation
$Cr_2O_7^{2-} + 14H^+ + 6e^- \rightarrow 2Cr^{3+} + 7H_2O$
The amount of Cr^{3+} obtained was $0.104g$. The efficiency of the process (in\%) is (Take: $F = 96000C$, At. mass of chromium $= 52$)

Q6 JEE Main 2020 - 4 September (Morning)



$\mathrm{E}^0_{\mathrm{Cu}^{2+}|\mathrm{Cu}} = +0.34\mathrm{V}$
$\mathrm{E}^0_{\mathrm{Zn}^{2+}|\mathrm{Zn}} = -0.76\mathrm{V}$
Identify the incorrect statement from the option below for the above cell:
(A) If $\mathrm{E}_{\mathrm{ext}} < 1.1\mathrm{V}, \mathrm{Zn}$ dissolves at anode and Cu deposits at cathode
(B) If $\mathrm{E}_{\mathrm{ext}} = 1.1\mathrm{V}$, no flow of e^- or current Occurs
(C) If $E_{\mathrm{ext}} > 1.1\mathrm{V}, \mathrm{e}^-$ flows from Cu to Zn
(D) If $\mathrm{E}_{\mathrm{ext}} > 1.1\mathrm{V}, \mathrm{Zn}$ dissolves at Zn electrode and Cu deposits at Cu electrode

Q7 JEE Main 2020 - 4 September (Evening)

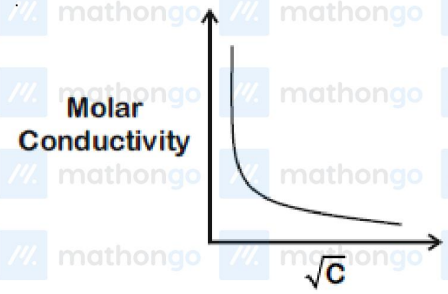
$250\mathrm{mL}$ of a waste solution obtained from the workshop of a goldsmith contains $0.1\mathrm{M}$ $AgNO_3$ and 0.1 M AuCl. The solution was electrolyzed at $2\mathrm{V}$ by passing a current of $1\mathrm{A}$ for 15 minutes. The metal/metals electrodeposited will be
$\left[\mathrm{E}^0_{\mathrm{Ag}^+/\mathrm{Ag}} = 0.80\mathrm{V}, \mathrm{E}^0_{\mathrm{Au}^+/\mathrm{Au}} = 1.69\mathrm{V}\right]$
(A) Silver and gold in equal mass proportion
(B) Silver and gold in proportion to their atomic weights
(C) Only gold
(D) Only silver

Q8 JEE Main 2020 - 5 September (Morning)

An oxidation-reduction reaction in which 3 electrons are transferred has a $\Delta\mathrm{G}^0$ of $17.37\mathrm{kJmol}^{-1}$ at $25^{\circ}\mathrm{C}$. The value of $\mathrm{E}^{\circ}_{\mathrm{cell}}$ (in V) is $\times 10^{-2}$
$\left(1\mathrm{F} = 96,500\mathrm{Cmol}^{-1}\right)$

Q9 JEE Main 2020 - 5 September (Evening)

The variation of molar conductivity with concentration of an electrolyte (X) in aqueous solution is shown in the given figure.



The electrolyte X is

(A) NaCl
(B) HCl
(C) $\mathrm{CH_3COOH}$
(D) $\mathrm{KNO_3}$

Q10 JEE Main 2020 - 6 September (Evening)

For the given cell;

$\mathrm{Cu(s)\left|Cu^{2+}\,(C_1M)\,\right|\left|Cu^{2+}\,(C_2M)\right|Cu(s)}$

change in Gibbs energy (ΔG) is negative, if

(A) $\mathrm{C_2 = \sqrt{2}C_1}$
(B) $\mathrm{C_2 = \frac{C_1}{\sqrt{2}}}$
(C) $\mathrm{C_1 = 2C_2}$
(D) $\mathrm{C_1 = C_2}$

Q11 JEE Main 2020 - 7 January (Morning)

Given that the standard potentials $\left(E^0\right)$ of Cu^{2+}/Cu and Cu^{+}/Cu are $0.34\ V$ and $0.522\ V$ respectively, the $\left(E^0\right)$ of Cu^{2+}/Cu^{+} is :

(A) $0.158\ V$
(B) $-0.158\ V$
(C) $0.182\ V$
(D) $-0.182\ V$

Q12 JEE Main 2020 - 7 January (Evening)

Which of the following is incorrect?

(A) $\Lambda_m^\circ NaCl - \Lambda_m^\circ NaBr = \Lambda_m^\circ KCl - \Lambda_m^\circ KBr$
(B) $\Lambda_m^\circ H_2O = \Lambda_m^\circ HCl + \Lambda_m^\circ NaOH - \Lambda_m^\circ NaCl$
(C) \Lambda _{m}^{\circ }NaBr-$\Lambda_m^\circ NaI = \Lambda_m^\circ KBr$-\Lambda _{m}^{\circ }NaBr
(D) $\Lambda_m^\circ NaCl - \Lambda_m^\circ KCl = \Lambda_m^\circ NaBr - \Lambda_m^\circ KBr$

Q13 JEE Main 2020 - 8 January (Morning)

What would be the electrode potential for the given half cell reaction at $pH = 5$?

Given : $2H_2O \rightarrow O_2 + 4H^+ + 4e^-$ $E_{red}^\circ = -1.23\,V$ ($R = 8.314\,J\,mol^{-1}K^{-1}$; Temp $= 298\,K$; oxygen under std.pressure of 1 bar)
Multiply your answer with -100

Q14 JEE Main 2020 - 8 January (Evening)

For an electrochemical cell $Sn\,(s)\,|Sn^{2+}\,(aq,\,1M)\,||Pb^{2+}\,(aq,\,1M)\,|Pb\,(s)$ the ratio $\frac{\left[Sn^{2+}\right]}{\left[Pb^{2+}\right]}$ when this cell attains equilibrium is. . . .
$(E^o{}_{Sn^{2+}/Sn} = -0.14V, E^o{}_{pb^{2+}/pb} = -0.13V,$
$\frac{2.303RT}{F} = 0.06)$

Multiply your answer with 100

Q15 JEE Main 2020 - 9 January (Morning)

$108\,g$ of silver (molar mass $108\,g\,mol^{-1}$) is deposited at cathode from $AgNO_3\,(aq)$ solution by a certain quantity of electricity. The volume (in L) of oxygen gas produced at $273\,K$ and 1 bar pressure from water by the same quantity of electricity is. . . .

Answer Key

Q1 (96500)
Q2 (144)
Q3 (Bonus)
Q4 (142)
Q5 (60)
Q6 (D)
Q7 (C)
Q8 (-6)
Q9 (C)
Q10 (A)
Q11 (A)
Q12 (C)
Q13 (93)
Q14 (215)
Q15 (5.67)