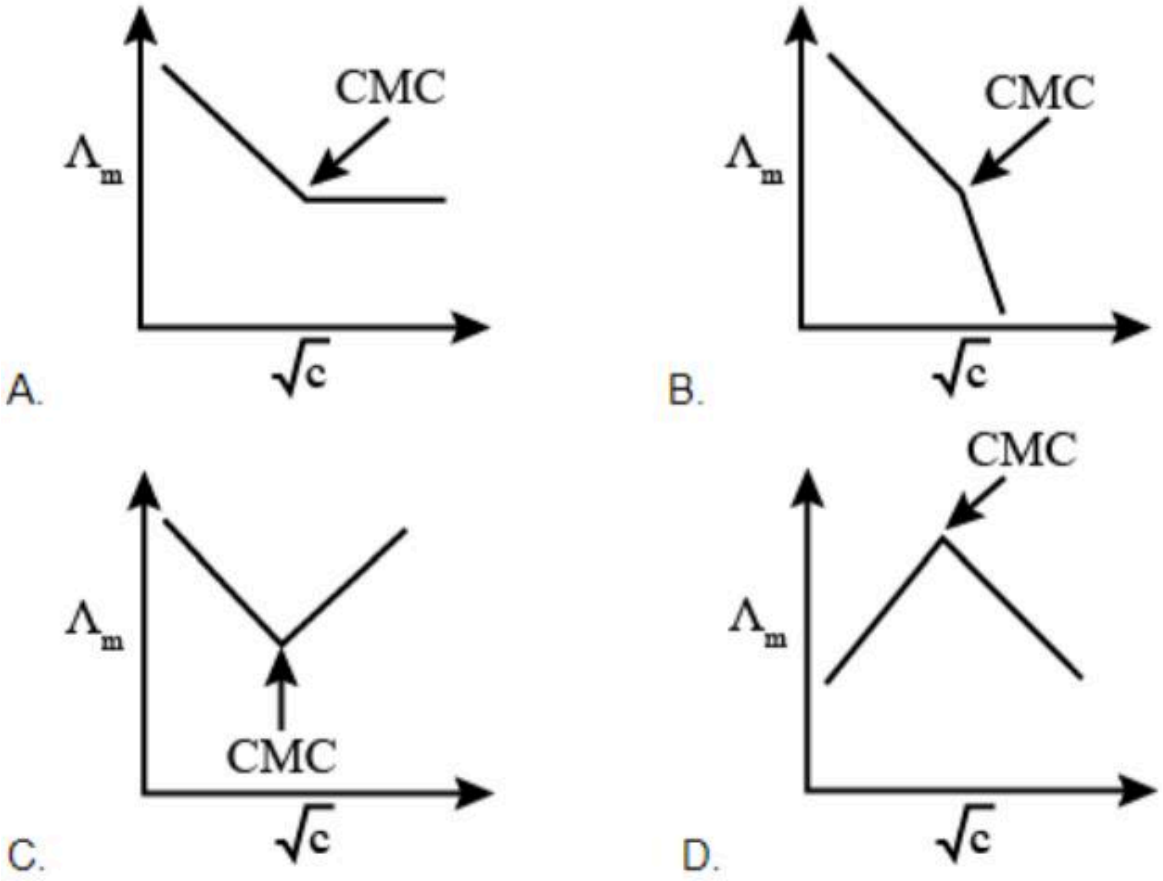
JEE Advanced Questions Based on Most Repeated Concepts of Electrochemistry

Q: Molar conductivity (Λ_m) of an aqueous solution of sodium stearate, which behaves as a strong electrolyte, is recorded at varying concentrations (c) of sodium stearate. Which one of the following plots provides the correct representation of micelle formation in the solution? (critical micelle concentration (CMC) is marked with an arrow in the figures).



Q: The conductance of a 0.0015M aqueous solution of a weak monobasic acid was determined by using a conductivity cell consisting of platinized Pt electrodes. The distance between the electrodes is 120 cm with an area of cross-section of $1cm^2$. The conductance of this solution was found to be 5×10^{-7}S. The pH of the solution is 4. The value of limiting molar conductivity (Λ_{om}) of this weak monobasic acid in an aqueous solution is Z × 10 2 S cm^{-1} mol^{-1} . The value of Z is

Q: Consider an electrochemical cell: A(s) | An^+ (aq, 2 M) || $B2n^+$ (aq, 1 M) | B(s). The value of ΔHθ for the cell reaction is twice that of ΔGθ at 300 K. If the emf of the cell is zero, the ΔSθ (in J K^{-1} mol^{-1}) of the cell reaction per mole of B formed at 300 K is ____. (Given: ln(2) = 0.7, R (universal gas constant) = 8.3 J K^{-1} mol^{-1}. H, S and G are enthalpies, entropy and Gibbs energy, respectively.)

Q: For the electrochemical cell, Mg(s)|Mg^{2+}(aq, 1M)||Cu^{2+} (aq, 1M) | Cu(s) the standard emf of the cell is 2.70 V at 300 K. When the concentration of Mg2+ is changed to x M, the cell potential changes to 2.67 V at 300 K. The value of x is____.

Q: The molar conductivity of a solution of a weak acid HX(0.01 M) is 10 times smaller than the molar conductivity of a solution of a weak acid HY(0.1 M). If $\lambda^\circ_x \approx \lambda^\circ_y$, the difference in their pKa values, pK_a (HX) − pK_a (HY), is (consider the degree of ionization of both acids to be <<1).

Q: All the energy released from the reaction X → Y, $\Delta_r G^\circ$ = -193J mol -1 is used for oxidizing M^+ as $M^+ \rightarrow M^{3+} + 2e^-$, E° = -0.25V. Under standard conditions, the number of moles of M^+ oxidized when one mole of X is converted to Y is [F = 96500 C mol -1].

Q: In a galvanic cell, the salt bridge:

A. Does not participate chemically in the cell reaction
B. Stops the diffusion of ions from one electrode to another
C. Is necessary for the occurrence of the cell reaction
D. Ensures mixing of the two electrolytic solutions

Q: Consider a 70% efficient hydrogen-oxygen fuel cell working under standard conditions at 1 bar and 298 K. Its cell reaction is;

H2 (g) + ½ O2 (g) → H2O(l)

The work derived from the cell on the consumption of 1.0 × 10 -3 mol of H2 (g) is used to compress 1.00 mol of a monoatomic ideal gas in a thermally insulated container. What is the change in the temperature (in K) of the ideal gas?

The standard reduction potentials for the two half-cells are given below.

O_2 (g) + $4H^+$(aq) + $4e^-$ → 2 H_2O (l), E° = 1.23 V

$2H^+$(aq) + 2^- → H_2 (g), E° = 0.00 V

Use F = 96500 C mol^{-1} , R = 8.314 J mol^{-1} K^{-1}

Q: For the following cell, Zn(s) | $ZnSO_4$ (aq) || $CuSO_4$ (aq) | Cu(s) when the concentration of Zn^{2+} is 10 times the concentration of Cu^{2+} , the expression for ΔG (in J mol^{-1}) is [F is Faraday constant; R is gas constant; T is temperature; E° (cell) = 1.1V].

Q: $AgNO_3$ (aq.) was added to an aqueous KCl solution gradually and the conductivity of the solution was measured. The plot of conductance (Λ) versus the volume of $AgNO_3$ is.