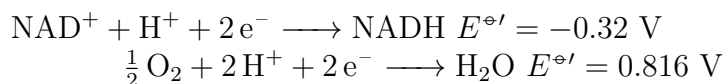


CHEM 361A - Lecture 14 Activity
Electrochemistry

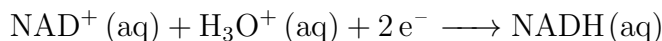
In Class

1. The conversion of NADH to NAD⁺ releases two electrons which are eventually used to reduce molecular oxygen to water in the terminal respiratory chain:



What is the change in the standard biochemical Gibbs Free Energy as a pair of electrons pass through the terminal respiratory chain?

2. One way to prevent a buried iron pipe from rusting is to connect it with a piece of wire to a magnesium or zinc rod. What is the electrochemical principle for this action?
3. For the reaction



$E^{\ominus'} = -0.320 \text{ V}$ at 25°C. Calculate the value of E' at pH = 1 and $[\text{NAD}^+] = [\text{NADH}] = 1$. Recall that the prime means that we are using the biochemical standard state meaning that m^{\ominus} for H_3O^+ is 1×10^{-7} . Assume $\gamma_{\pm} = 1$.

4. A sodium ion channel which transports Na⁺-ions across a cell membrane can be described by the following reaction:



At equilibrium, if the $[\text{Na}_{\text{outside}}^+] = 0.143 \text{ M}$, what is $[\text{Na}_{\text{inside}}^+]$ at 37°C?

Homework

5. You have an electrochemical cell setup with the following Daniell Cell



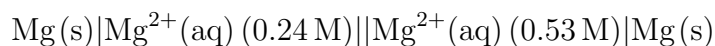
At 25°C, determine

- (a) E^{\ominus} (0.0113 V)
- (b) ΔG^{\ominus} (-2180.9 J mol⁻¹)

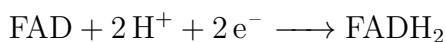
(c) K (2.4)

(d) The ratio of $[\text{Sn}^{2+}]/[\text{Pb}^{2+}]$ at equilibrium. Assume $\gamma_{\pm} = 1$. Recall that when writing a chemical reaction for redox chemistry that the anode half-cell reaction is the forward reaction, and the cathode half-cell reaction is the reverse reaction. Assume γ_{\pm} is the same for all ionic species. (2.4)

6. Calculate the EMF of the Daniell Cell below at 25°C. Assume $\gamma_{\pm} = 1$. (0.010 V)



7. Flavin Adenine Dinucleotide (FAD) participates in several biological redox reactions according to the half-reaction



If the value of $E^{\circ'}$ of this reaction is -0.219 V at 25°C, and pH 7, calculate its reduction potential at this temperature and pH when the solution contains

(a) 85% of the oxidized form (-0.197 V)

(b) 15% of the oxidized form (-0.241 V)

For both cases, assume $\gamma_{\pm} = 1$.