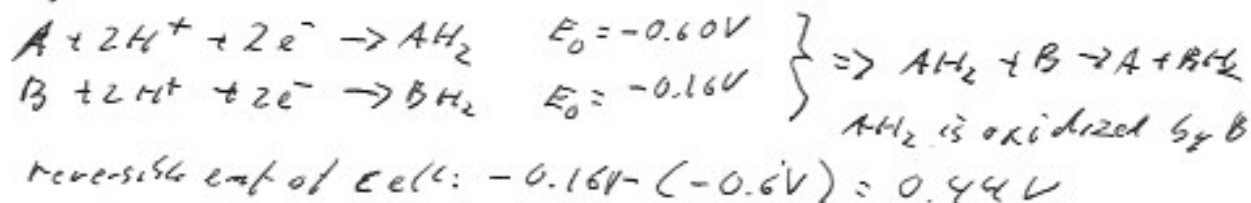


1. Under standard conditions, a solution containing A and its reduced form AH_2 has a standard electrode potential of -0.6 V. A solution containing B and BH_2 has a standard potential of -0.16 V. If a cell were constructed with these two systems as half-cells, would AH_2 be oxidized by B or BH_2 oxidized by A? What would be the reversible emf of the cell?



2. The solubility of $AgCl$ in water at $25^\circ C$ is 1.274×10^{-5} mol dm^{-3} . On the assumption that the Debye-Hückel limiting law applies,

a. Calculate ΔG° for the process $AgCl(s) \rightarrow Ag^+(aq) + Cl^-(aq)$.

$$s = 1.274 \times 10^{-5} \text{ mol/l}; \quad K_s = s^2 \gamma_{\pm}^2; \quad \log_{10} \gamma_{\pm} = z_+ |z_-| \cdot 0.51 \cdot \sqrt{I}$$

$$\Rightarrow K_s = (0.996 \cdot 1.274 \times 10^{-5})^2 = 1.609 \times 10^{-10}$$

$$\Delta G^\circ = -RT \ln K_s = 55.90 \text{ kJ/mol} \quad \Rightarrow \gamma_{\pm} = 0.996$$

$$\log_{10} \gamma_{\pm} = z_+ |z_-| \cdot 0.51 \cdot \sqrt{I} = 0.51 \sqrt{I} \quad (I = \frac{1}{2} \sum c_i z_i^2 = -1.82 \times 10^{-3})$$

b. Calculate the solubility of $AgCl$ in an 0.005 M solution of K_2SO_4 .

$$I = \frac{1}{2} \sum c_i z_i^2 = \frac{1}{2} (0.005M \times 1^2 + 0.005M \times 1^2 + 0.005M \times 2^2) = 0.015M$$

$$\log_{10} \gamma_{\pm} = z_+ |z_-| \cdot 0.51 \cdot \sqrt{I} = -0.51 \cdot 1 \cdot 1 \cdot \sqrt{0.015} = -0.0625$$

$$\Rightarrow \gamma_{\pm} = 0.866; \quad K_s = \text{const} = 1.609 \times 10^{-10} \text{ (from a)} = s^2 \gamma_{\pm}^2$$

$$\Rightarrow s = \frac{\sqrt{K_s}}{\gamma_{\pm}} = \frac{\sqrt{1.609 \times 10^{-10}}}{0.866} = 1.46 \times 10^{-5} M$$

3. A 0.1 M solution of sodium palmitate, $C_{15}H_{31}COONa$, is separated from a 0.2 M solution of sodium chloride by a membrane that is permeable to Na^+ and Cl^- ions but not to palmitate ions. Calculate the concentrations of Na^+ and Cl^- ions on the two sides of the membrane after equilibrium has become established.

	palmitate side	other side
initial concentrations	$[Na^+] = 0.1M$ $[P^-] = 0.1M$	$[Na^+] = 0.2M$ $[Cl^-] = 0.2M$
Final concentrations	$[Na^+] = 0.1M + x$ $[P^-] = 0.1M$ $[Cl^-] = x$	$[Na^+] = 0.2M - x$ $[Cl^-] = 0.2M - x$

$$\Rightarrow (0.2M - x)^2 = (0.1 + x)x \Rightarrow x = 0.08$$

$$\Rightarrow \text{Palmitate side: } [Na^+] = 0.18M, [Cl^-] = 0.08M; \text{ other side: } [Na^+] = [Cl^-] = 0.12M$$