

Chemistry-4311
November 15, 2013

Quiz #9

Name Key

$R = 8.314 \text{ J/mol-K} = 0.08206 \text{ L-atm/mol-K} = 1.987 \text{ cal/mol-K}$, $N_A = 6.02 \times 10^{23}$, $F = 96,500 \text{ C}$

5 1. Matching (Use a letter only once)
 ΔG_r for an electrochemical cell is i.

The equilibrium constant and standard emf E° are related by f.

Biological standard reduction potentials are for a pH of a.

The Nernst equation is h.

The membrane potential ΔE for K^+ ions is e.

- a. seven
- b. $E^\circ = RT \ln K$
- c. $E = E^\circ - RT \ln Q$
- d. $\Delta S - T \Delta H$
- e. $0.257 \text{ V} \ln \{ [K^+]_{\text{ex}} / [K^+]_{\text{in}} \}$
- f. $E^\circ = RT \ln K / vF$
- g. zero
- h. $E = E^\circ - RT \ln Q / vF$
- i. $-vFE$
- j. $0.257 \text{ V} \ln [K^+]$

2. $E^\circ = 1.507 \text{ V}$ for the reduction reaction $\text{MnO}_4^- + 8\text{H}^+ + 5\text{e}^- \rightarrow \text{Mn}^{2+} + 4\text{H}_2\text{O}$. Show how to calculate the biological standard reduction potential E°' .

$$\Delta G_r = \Delta G_r^\circ + RT \ln Q$$

$$-vFE = -vFE^\circ + RT \ln Q$$

$$E = E^\circ - \frac{RT}{vF} \ln Q$$

For biological standard state $[\text{H}^+] = 1.0 \times 10^{-7} \text{ M}$

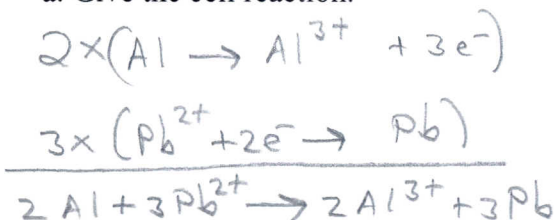
$$E^\circ' = E^\circ - \frac{RT}{5F} \ln \frac{1}{[1.0 \times 10^{-7}]^8}$$

The concentration of everything else is $[1.0]$.

3. An electrochemical cell consists of the half-cells



a. Give the cell reaction.



$$E^\circ = 1.662$$

$$E^\circ = -0.126$$

$$E^\circ = 1.536 \text{ V}$$

b. What is E° for the cell?

$$E^\circ = 1.536$$