Chemistry 145, Fall 1998 Final

Prof. Shattuck Name________________________________

Note: Here are some typical problems from a previous longer final. The Colby portion of the 2014 final will be one hour.

Part 1: 8 points each.

1\. . The change in entropy for the phase transition PCl_5 (s) $\rightarrow$ PCl_5(g) is
(a) positive (b) negative c) about zero

6\. Will NO_3^- oxidize Cu to Cu^{2+} under standard conditions? Show your work for credit. Note:

$NO_3^- + 4H^+ + 3\,e^- = NO + 2\,H_2O$ E° = 0.96 V

$Cu^{2+} + 2\,e^- = Cu(s)$ E° = 0.34 V

7\. Name the following compounds or supply the formula:

a. KNO_2 ________________________

b. $NaClO_3$ _______________________

c. phosphorous acid _______________

8\. The reaction $3Cd(s) + 2\,Al^{3+} = 3Cd^{2+} + 2\,Al(s)$ has a negative standard cell voltage. Is the equilibrium constant

(a) greater than 1 (b) less than 1 (c) can't tell from the information given

10\. For the reaction $Cd(s) + 2\,Fe^{3+} = Cd^{2+} + 2\,Fe^{2+}$ the standard cell potential is E° = 0.371 V. Calculate the cell potential if $[Fe^{3+}]$ = 0.100M and $[Cd^{2+}] = [Fe^{2+}]$ = 0.010 M.

15\. In the electrolysis of a solution containing Cd^{2+} ions, 0.500 g of Cd are plated out using a current of 0.500 amp. How much time does this take?.

23. Calculate ΔG for the reaction $NO(g) + O_3(g) \rightarrow NO_2(g) + O_2(g)$ at 298.2K when the pressures are as follows: $P_{NO} = 1.00x10^{-6}$, $P_{O_3} = 1.00x10^{-6}$, $P_{NO_2} = 1.00x10^{-7}$, and $P_{O_2} = 1.00x10^{-4}$. $\Delta G° = -198$ kJ for this reaction.

Helpful Formulas and Constants

$h = 6.63x10^{-34}$ J sec $c=3.0x10^{8}$ m sec^{-1} $N_A = 6.02x10^{23}$ mol^{-1}

$R = 8.314$ J mol^{-1} K^{-1} = 0.08206 L atm mol^{-1} K^{-1} T(0°C) = 273.15 K

F = 96485 C mol^{-1} 1 L atm = 101.3 J

$\pi = MRT$ $q = mC_s\Delta T$ $w = -P\Delta V$ $\Delta H = \Delta E + \Delta(PV)$

$$\ln\left(\frac{P_2}{P_1}\right) = -\frac{\Delta H_{vap}}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \qquad \ln\left(\frac{k_2}{k_1}\right) = -\frac{\Delta E_a}{R}\left(\frac{1}{T_2} - \frac{1}{T_1}\right) \qquad \ln\left(\frac{[A]}{[A]_o}\right) = -kt \qquad \frac{1}{[A]} - \frac{1}{[A]_o} = kt$$

$$t_{1/2} = \frac{0.693}{k} \qquad t_{1/2} = \frac{1}{k\,[A]_o} \qquad \Delta G = \Delta G^o + RT \ln Q$$

$$E = E^o - \frac{RT}{nF}\ln Q \qquad E = E^o - \frac{0.0257\ V}{n}\ln Q \qquad E = E^o - \frac{0.0592\ V}{n}\log Q$$