Quiz 7 Name:_____

Chem 1B, Spring 2020

Fossum

$\Delta G° = - nFE°$ F = 96485 C/mole 1 V = 1 J/C

$$E = E° - \frac{0.0257\ V}{n} \ln Q$$

Always show your work and explain your reasoning, include units, and check significant figures.

Standard Reduction Potentials at 25°C

Half reaction	E°, V
$Ag^+ + e^- \rightarrow Ag_{(s)}$	0.799
$Au^+ + e^- \rightarrow Au_{(s)}$	1.68
$Au^{3+} + 3e^- \rightarrow Au_{(s)}$	1.50
$Pb^{2+} + 2e^- \rightarrow Pb_{(s)}$	- 0.126
$Cl_{2\,(g)} + 2e^- \rightarrow 2\ Cl^-$	1.359
$Co^{2+}_{(aq)} + 2e^- \rightarrow Co_{(s)}$	- 0.277
$Cr^{3+}_{(aq)} + 3e^- \rightarrow Cr_{(s)}$	- 0.740
$Fe^{2+} + 2e^- \rightarrow Fe_{(s)}$	- 0.440
$Fe^{3+} + e^- \rightarrow Fe^{2+}$	0.771
$H_2O_{2\,(aq)} + 2H^+_{(aq)} + 2e^- \rightarrow 2\ H_2O_{(l)}$	1.776
$O_{2\,(g)} + 4H^+_{(aq)} + 4e^- \rightarrow 2\ H_2O_{(l)}$	1.23
$2\ H_2O_{(l)} + 2e^- \rightarrow H_{2\,(g)} + 2\ OH^-_{(aq)}$	- 0.83

1. (6) a. List all possible reduction and oxidation half-reactions for the electrolysis of aqueous $FeCl_2$ using gold electrodes.

b. Predict the half reactions that would actually happen at the anode and at the cathode and explain your reasoning.

c. What would you expect to see happening at the anode and at the cathode?

2. (5) a. Calculate $\Delta G°$ for the reaction:

$Pb_{(s)} + 2\ Ag^{+}_{(aq)} \rightarrow Pb^{2+}_{(aq)}\ \ 2\ Ag_{(s)}$

b. Is this reaction spontaneous or not under standard conditions? How can you tell?

3. (9) a. A galvanic cell is assembled. One compartment contains a chromium electrode and 0.250 M $Cr(NO_3)_{3\,(aq)}$ solution. The other compartment contains a cobalt electrode, water, and solid $Co(OH)_2$. The K_{sp} for $Co(OH)_2$ is 1.3×10^{-15}. Determine the overall voltage of this cell. (Hint: first find the overall redox reaction and overall E° value.)

b. Under these conditions, is the redox reaction *more favorable* or *less favorable* than standard conditions? Explain why this is (the underlying chemical reason).