CHEM 1032 – Week 13 Questions

1. Which electrode is being oxidized in a Zn and Cu galvanic cell?

2. Which electrode loses mass in a Zn and Cu galvanic cell?

3. What is the value of Gibbs free energy in a Zn and Cu galvanic cell?

4. What is the value of K in a Zn and Cu galvanic cell?

5. Which cell would you expect to be more spontaneous?
   a. $[Cu^{2+}] = 0.34$ M and $[Zn^{2+}] = 1.5$ M
   b. $[Cu^{2+}] = 1.5$ M and $[Zn^{2+}] = 0.34$ M

6. What is the value of Ecell for when $[Cu^{2+}] = 0.34$ M and $[Zn^{2+}] = 1.5$ M?

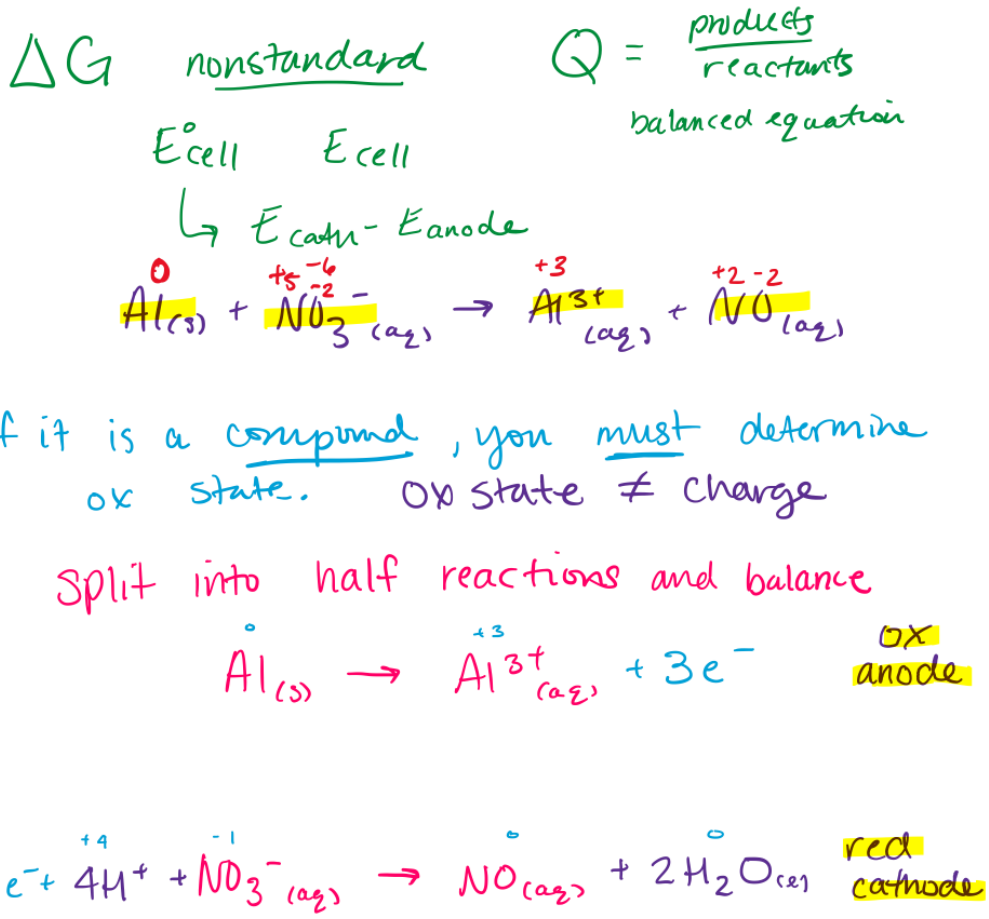
7. What is the value of Ecell for a Zn concentration cell?

8. What mass of Ag can be plated by the flow of 3.6 A for 30 min?

9. A metal forms the fluoride MF_3. Electrolysis of the molten fluoride by a current of 3.86 A for 16.2 min deposits 0.3496 g of metal. What is the metal?

10. Determine the value of ΔG if the concentrations for the system are Al^{3+} 2.5 M, NO_3^- 0.056 M, NO 1.5 M. The system is at a pH of 5.2.

$$Al_{(s)} + NO_3^-{}_{(aq)} \rightarrow Al^{3+}{}_{(aq)} + NO_{(aq)}$$



Recombine, because $3e^- = 3e^-$

$$Al_{(s)} + 4H^+_{(aq)} + NO_3^-{}_{(aq)} \rightarrow Al^{3+}_{(aq)} + NO_{(aq)} + 2H_2O_{(l)}$$

Calculate E°_{cell}

$$E^\circ_{cell} = E_{cathode} - E_{anode}$$

$$E^\circ_{cell} = 0.96V - -1.66V = 2.62\,V$$

Because we want ΔG (nonstandard) we need to see how Q affects E_{cell}!

$$Q = \frac{[Al^{3+}][NO]}{[H^+]^4[NO_3^-]}$$

$[H^+] = 10^{\wedge -pH}$

$= 10^{\wedge -5.2}$

$= 6.31 \times 10^{-6}$

$$Q = \frac{(2.5)(1.5)}{(6.3\times10^{-6})(0.056)}$$

$$Q = 4.25\times10^{22}$$

Now we can calculate nonstandard E_{cell}

$$E_{cell} = E^\circ_{cell} - \frac{0.0592V}{n}\log Q$$

$$E_{cell} = 2.62V - \frac{0.0592V}{3}\log(4.25\times10^{22})$$

$$E_{cell} = 2.62V - 0.45\,V$$

$$E_{cell} = 2.17\,V$$

Now we can solve for nonstandard ΔG

$$\Delta G = -nFE_{cell}$$

$$\Delta G = -(3)(96{,}485)(2.17\,V)$$

$$= -628117\,J$$

or

$$-628.117\,kJ$$