CHM 1046 - JOENS WORKSHEET #10 Due date: Monday, November 27th
(Note: Exam 3 is Friday, December 1st. It will cover material from Chapters 17 and 18).
WORKSHEETS ARE DUE AT THE BEGINNING OF CLASS ON THE DATE GIVEN ON THE WORKSHEET. LATE WORKSHEETS WILL NOT BE ACCEPTED.

NAME _____ Panther ID _____

For problems involving calculations you must show your work for credit.

1) Consider the following galvanic cell

$Cd(s) \mid Cd^{2+}(1.0 \times 10^{-4}\ M) \parallel Ni^{2+}(0.0400\ M) \mid Ni(s)$

Give the half-cell oxidation reaction, the half-cell reduction reaction, and the net cell reaction corresponding to the above galvanic cell. Also find the values for E_{cell} and $E°_{cell}$.

ox $Cd(s) \rightarrow Cd^{2+}(aq) + 2\ e^-$ $E°_{ox} = + 0.40$ v

red $Ni^{2+}(aq) + 2\ e^- \rightarrow Ni(s)$ $E°_{red} = - 0.25$ v

net $Cd(s) + Ni^{2+}(aq) \rightarrow Cd^{2+}(aq) + Ni(s)$ $E°_{cell} = + 0.15$ v

$Q = [Cd^{2+}]/[Ni^{2+}] = (1.0 \times 10^{-4})/(0.0400) = 2.5 \times 10^{-3}$

$$E_{cell} = E°_{cell} - (RT/nF) \ln Q = 0.15\ v - \frac{(8.314\ J/mol{\cdot}K)(298.2\ K)}{(2)(96485.\ C/mol)} \ln(2.5 \times 10^{-3}) =$$

$$0.15\ v + 0.077\ v = 0.23\ v$$

2) Which of the following statements is correct?

a) In a galvanic cell, oxidation occurs at the cathode
b) In a galvanic cell, oxidation occurs at the anode
E c) In an electrolytic cell, oxidation occurs at the anode
d) Both a and c
e) Both b and c

3) For the galvanic cell

$$M(s) \mid M^{3+}(aq) \parallel Cu^{2+}(aq) \mid Cu(s)$$

the experimental value for the cell voltage for standard conditions is $E°_{cell} = + 0.08$ v. Based on this information find the standard half-cell reduction potential for the process

$$M^{3+}(aq) + 3\ e^- \rightarrow M(s)$$

ox $\quad 2\ M(s) \rightarrow 2\ M^{3+}(aq) + 6\ e^-$ $\qquad E°_{ox} = \ ?$

red $\quad 3\ Cu^{2+}(aq) + 6\ e^- \rightarrow 3\ Cu(s)$ $\qquad E°_{red} = + 0.34$ v

net $\quad 2\ M(s) + 3\ Cu^{2+}(aq) \rightarrow 2\ M^{3+}(aq) + 3\ Cu(s)$ $\qquad E°_{cell} = + 0.08$ v

$E°_{cell} = E°_{ox} + E°_{red}$ $\qquad E°_{ox} = E°_{cell} - E°_{red} = + 0.08$ v $- 0.34$ v $= - 0.26$ v

So for the reduction reaction $\quad M^{3+}(aq) + 3\ e^- \rightarrow M(s) \quad E°_{red} = - E°_{ox} = + 0.26$ v

4) Electrolysis is a common method for producing reactive metals. In a laboratory experiment, a 20.0 ampere current passes through a molten sample of $MgCl_2$ for a period of 8.00 hours. How many grams of magnesium metal will form?

$$\text{moles charge} = 8.00\ \text{hr} \ \frac{3600\ \text{s}}{1\ \text{hr}} \ \frac{20.0\ \text{C}}{\text{s}} \ \frac{1\ \text{mol}}{96485.\ \text{C}} = 5.970\ \text{mol charge}$$

$$\text{so mass Mg} = 5.970\ \text{mol charge} \ \frac{1\ \text{mol Mg}}{2\ \text{mol charge}} \ \frac{24.31\ \text{g Mg}}{\text{mol Mg}} = 72.6\ \text{g Mg}$$