

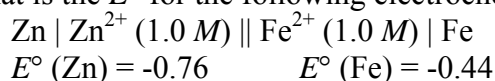
## CH 302 Spring 2005

### Worksheet 9: Electrochemistry

1. (a) Calculate the mass of copper metal produced at the cathode during the passage of 2.50 amps of current through a solution of copper (II) sulfate for 50.0 minutes.

(b) What volume of oxygen gas (measured at STP) is produced by the oxidation of water at the anode in the electrolysis of copper(II) sulfate in part (a)?

2. What is the  $E^\circ$  for the following electrochemical cell where Zn is the cathode?

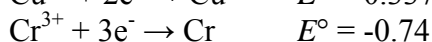
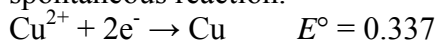


3. For the electrolysis of molten sodium bromide, write the two half-reactions and show write which electrode at which each occurs (cathode or anode).

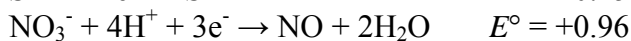
4. Calculate the potential,  $E$ , for the  $\text{Fe}^{3+}/\text{Fe}^{2+}$  electrode when the concentration of  $\text{Fe}^{2+}$  is exactly five times that of  $\text{Fe}^{3+}$ .



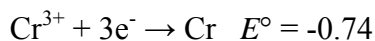
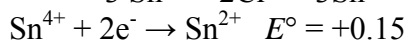
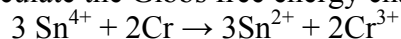
5. At standard conditions, will chromium (III) ions,  $\text{Cr}^{3+}$ , oxidize metallic copper to copper (II) ions,  $\text{Cu}^{2+}$ , or will  $\text{Cu}^{2+}$  oxidize metallic chromium to  $\text{Cr}^{3+}$  ions? Write the cell reaction and calculate  $E^\circ_{\text{cell}}$  for the spontaneous reaction.



6. In an acidic solution at standard conditions, will tin(IV) ions,  $\text{Sn}^{4+}$ , oxidize gaseous nitrogen oxide, NO, to nitrate ions,  $\text{NO}_3^-$ , or will  $\text{NO}_3^-$  oxidize  $\text{Sn}^{2+}$  to  $\text{Sn}^{4+}$  ions? Write the cell reaction and calculate  $E^\circ_{\text{cell}}$  for the spontaneous reaction.



7. Calculate the Gibbs free energy change,  $\Delta G^\circ$ , in J/mol at  $25^\circ\text{C}$  for the following reaction:



8. Use the standard cell potential to calculate the value of the equilibrium constant, K, at  $25^\circ\text{C}$  for the following reaction.



9. The following cell is maintained at  $25^\circ\text{C}$ . One half-cell consists of a chlorine/chloride,  $\text{Cl}_2/\text{Cl}^-$ , electrode with the partial pressure of  $\text{Cl}_2 = 0.100$  atm and  $[\text{Cl}^-] = 0.100$  M. The other half-cell involves the  $\text{MnO}_4^-/\text{Mn}^{2+}$  couple in acidic solution with  $[\text{MnO}_4^-] = 0.100$  M,  $[\text{Mn}^{2+}] = 0.100$  M, and  $[\text{H}^+] = 0.100$  M. Apply the Nernst equation to the overall cell reaction to determine the cell potential for this cell.

