CHM152 Quiz 9a 25 Pts Spring 2009 Name: Key

1. (8 Pts) Use the Standard Potentials given below to answer the following questions:

$Fe^{2+}(aq) + 2e^- \leftrightarrows Fe(s)$ $E^o = -0.41$ V
$Sn^{2+}(aq) + 2e^- \leftrightarrows Sn(s)$ $E^o = -0.14$ V
$Ag^+(aq) + e^- \leftrightarrows Ag(s)$ $E^o = +0.80$ V

a. Which element or ion in the reactions above is the strongest oxidizing agent? Ag^+
b. Which element or ion in the reactions above is the strongest reducing agent? Fe
c. Calculate the cell potential for a voltaic cell using iron and silver as electrodes. Make sure it is a spontaneous reaction and show which reaction is oxidation and which reaction is reduction.

$Fe(s) \rightarrow Fe^{2+} + 2e^-$ (oxidation) $E^o = +0.41$ V
$Ag^+ + e^- \rightarrow Ag(s)$ (reduction) $E^o = +0.80$ V
$E^o_{cell} = +1.21$ V

2. (10 Pts) Balance the following redox reactions:

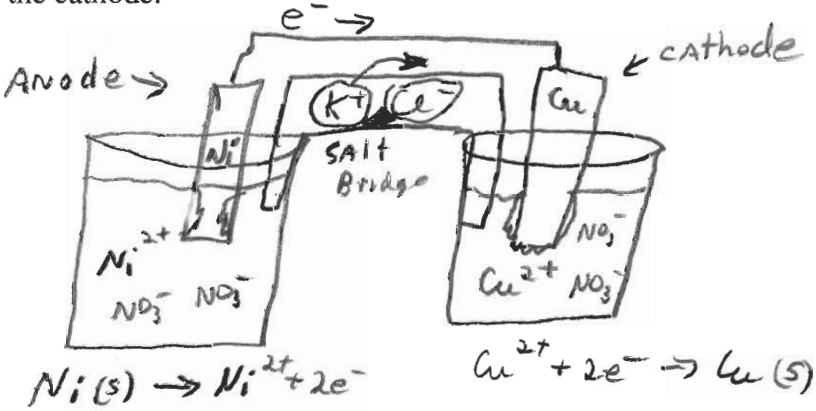
a. $MnO_2 + HNO_2 \rightarrow Mn^{2+} + NO_3^{1-}$ (acidic)

$MnO_2 + 4H^+ + 2e^- \rightarrow Mn^{2+} + 2H_2O$
$HNO_2 + H_2O \rightarrow NO_3^- + 3H^+ + 2e^-$
$MnO_2 + HNO_2 + H^+ \rightarrow Mn^{2+} + NO_3^- + H_2O$

b. $MnO_4^{1-} + C_2O_4^{2-} \rightarrow MnO_2 + CO_2$ (basic)

$\times 2$ $2MnO_4^- + 8H^+ + 6e^- \rightarrow 2MnO_2 + 4H_2O$
$\times 3$ $3C_2O_4^{2-} \rightarrow 6CO_2 + 6e^-$
$2MnO_4^- + 3C_2O_4^{2-} + 8H^+ \rightarrow 2MnO_2 + 6CO_2 + 4H_2O$
$+ 8OH^- \quad 8OH^- = 8H_2O$
$2MnO_4^- + 3C_2O_4^{2-} + 4H_2O \rightarrow 2MnO_2 + 6CO_2 + 8OH^-$

3. (7 Pts) Use the following reactions to draw and label a voltaic cell.
$Ni^{2+}(aq) + 2e^- \leftrightarrows Ni(s)$ $E^o = -0.23$ V; $Cu^{2+}(aq) + 2e^- \leftrightarrows Cu(s)$ $E^o = +0.34$ V.
Be sure to label the anode, cathode, and salt bridge. Then:
a. show the direction of electron flow, cation flow, and anion flow.
b. show the relative size changes of the electrodes.
c. use standard shorthand notation to describe the cell showing which end is the anode and which end is the cathode.



$Ni(s) \rightarrow Ni^{2+} + 2e^-$ $Cu^{2+} + 2e^- \rightarrow Cu(s)$

$Ni(s) | Ni^{2+} || Cu^{2+} | Cu(s)$

$E^o_{cell} = +0.57$ V