Chem 223-Exam 2 answers
1a) at lower temperatures b) always spontaneous

2. $\Delta G=-RTlnK=0.008314*(359)*\ln(5.3*10^{3})=-25.6KJ$

3. $K=e^{-(\Delta G/RT)}=e^{-(23.1/(.008314*298))}=8.9*10^{-5}$

4. $\Delta S=\Delta H/T=16.1KJ/213K=0.075KJ/K=75J/K$

5. a) $Au^{3+} + Fe^{2+} <=> Au^{+} + Fe^{3+}$ n=2
$E^{o}=1.40-0.77=0.63V$
$\Delta G^{o}= -nFE^{o} = -2(95.5)(0.63)= -122KJ$
$K=e^{(nEo/0.0257)}= e^{(2*0.63/0.0257)}=1.96*10^{21}$

b) $I_2 + 2Hg(l) <=> 2I^{-} + Hg_2^{2+}$
$E^{o}=0.54-0.80=-0.26V$
$\Delta G^{o}= -nFE^{o} = -2(95.5)(-0.26)= 50.2KJ$
$K=e^{(nEo/0.0257)}= e^{(2*-0.26/0.0257)}=1.63*10^{-9}$

6a) $14H^{+} + Cr_2O_7^{2-} + 3Fe <=> 2Cr^{3+} + 3Fe^{2+} + 7H_2O$
b) $2OH^{-} + SO_3^{2-} + 4ClO_2 <=> S(s) + 4ClO_3^{-} + H_2O$

7. As written the reaction is nonspontaneous since nitrate is below Mn^{2+} in the EC series. Thus the reaction will be driven left to right. The cathode is the site of reduction. Left to right the reduction is NO_3^{-} => NO for which n=3 and the product is NO(gfw=30).
Coulombs=amps*t(sec)=$3.2*2.90*3600=3.34*10^{4}$
Faradays=couls/96500=$3.34*10^{4}/96500=0.346$
moles NO=0.346/3=0/115 Mass=0.115*30=3.45g

8. $OH^{-} + F_2 + Cl_2 <=> F^{-} + ClO^{-} + H_2O$

9. $V|V^{3+}||Sn^{4+},Sn^{2+}|C(s)$

10. $Q=1/([H^{+}]^{6}*[MnO_4^{-}]^{2})=1/(.5^{5}*.2^{2})=1600$ n=6 (2*3(for the MnO_4^{-})
E=1.68-0.0257/6*ln(1600)=1.65V

11. a) $F_2 + Fe <=> F- + Fe^{2+}$; **yes**-$F_2$ is at the top of the EC series and will oxidize everything
b) $Co^{2+} + Br^{-} <=> Co(s) + Br_2$, **no** Co^{2+}(OA) is below Br^{-}
c) $Fe^{2+} + Ni(s) <=> Fe(s) + Ni^{2+}$,**no** Fe^{2+}(OA) is below Ni(s)
d) $S(s) + Cd(s) <=> H_2S + Cd^{2+}$,**yes** S(s)(OA) is above Cd(s)
e) numerous possibilities-any oxidizing agent between Sn(s) (-0.14V) and Fe^{2+}(0.77V)

12.a) Faraday's calculations deal with each ½ reaction independently so the balanced equation is not needed
b) chrome plating is a physical barrier to water and oxygen so it must remain intact. Galvanization provides a sacrificial anode which makes the iron cathodic
c) permanganate reactions require high concentrations of H^{+} ($4H^{+} + MnO_4^{-} => MnO_2 + 2H_2O$) to go to any real degree. This corresponds to low pH.

d) ΔH and ΔS have the same sign (both positive or both negative)