This is ACA # 32. It is OK to use your textbook, but if you can answers the questions without it that is OK too.

I recommend you print out this page and bring it to class. Click here to show a set of five ACA32 student responses, randomly selected from all of the student responses thus far, in a new window.

John , here are your responses to the ACA and the Expert's response.

For this ACA we will use this short version of the Standard Reduction Potential Table. You might want to print the table out before beginning the ACA.

Answer the following questions using the SRP Table.

1. Predict the products given the following reactants

a) $Zn(s) + Pb^{2+}(aq)$ ---->

correct products/wrong balance 6%

Zn(s) + Pb2+(aq) ----> Zn2+(aq)+ Pb(s) 89%

the products are $Zn^{2+}(aq) + Pb(s)$ the E^o for the reaction is +0.63 v.

b) $Ni(s) + Mn^{2+}(aq)$ ---->

$Ni^{2+} + Mn$ 1%

$MnO_4^- + H^+$ 12%

no reaction 22%

There is no reaction (NR) becasue the E^o for reaction is -0.93 v

c) $Ag(aq) + NO_3^-(aq) + H^+(aq)$ ---->

charge issues 11%

3Ag(s) + NO3^-(aq) + 4H+(aq) ----> 3Ag^+(aq) + NO(g) + 2H2O(l) 83%

$Ag^+(aq) + NO(aq) + H_2O(l)$

The overall balanced reaction is

$3Ag(s) + NO_3^-(aq) + 4H^+(aq)$ ----> $3Ag^+(aq) + NO(aq) + 2H_2O(l)$

The E^o for above reaction is +0.16 v

2. Copper will dissolve in nitric acid according to the following reaction

$$3Cu(s) + 2NO_3^-(aq) + 8H^+(aq) \text{ ----> } 3Cu^{2+}(aq) + 2NO(g) + 4H_2O(l)$$

a) Calculate E^o for the reaction

44%

1.3v 22%
? 34%

E^o = 0.62 volts

E^o = +0.62 Volts

Half-reaction	E° (volts)
$3Cu(s) \text{ ----> } 3Cu^{2+}(aq) + 6e^-$	-0.34
$6e^- + 2NO_3^-(aq) + 8H^+(aq) \text{ ----> } 2NO(g) + 4H_2O(l)$	+0.96

b) Write the equilibrium expression for the reaction in Question 2. (Remember how we handle substances in the solid phase. Be careful...the equilibrium expression will include both gas phase and aqueous phase species.)

17%

[NO]² 28%
[Cu] 28%
[ ] 17%

K = ([Cu^2+]^3·P(NO)^2)/([NO3^-]^2·[H^+]^8

$K = [Cu^{2+}]^3 P(NO)^2/[NO_3^-]^2 [H^+]^8$

c) What is the concentration of all the ions in the reaction for the E^o to have the value that you calculated from the SRP table? (NOTE: for the NO the pressure must be 1 atm for the value of the E^o you calculate.)

56%

$[NO_3^-] = [H^+] = [Cu^{2+}]$ = 1.0 M

$[NO_3^-] = [H^+] = [Cu^{2+}]$ = 1 M The concentration of any ion understandard conditions is by definition 1.00 M. Any gas understandard condition has a partial pressure of 1.00 atm.

d) How many electrons are transferred in the balanced chemical reaction?

n = 6 44% 17% 2e⁻

n = 6 electrons transferred int he balanced chemical reaction.

d) Calculate the Q when

$[NO_3^-]$ = 1.00 M, $[H^+]$ = 1.0 x 10^{-7} M, $[Cu^{2+}]$ = 1.00 M and the P(NO) = 1 atm

Q = 1e56 22% 1e-56 17% 1e+7 11 1e-7 6%

$Q = [Cu^{2+}]^3 P(NO)^2/[NO_3^-]^2 [H^+]^8 = [1]^3 (1)^2/[1]^2 [1.0 \times 10^{-7}]^8 = 1.0 \times 10^{56}$

e) Calculate the E_{cell} under the following conditions.

E_{cell} = +0.07 volts 22%

$E^o = E^o - (0.0257/n) \ln Q = E^o - (0.0257/6) \ln 1.0 \times 10^{56}$

E^o = +0.62 v - 0.55 v = +0.07 v

While the reaction appears to still be positive, there are some other issues (the production of a gas) which will make this reaction unlikely to occur. For many oxidation-redction reactions that produce gases the reaction (although spontaneous) will not occur unless the E^o is +0.20 - +0.40 v positive. In this case the reaction is only 0.07 v positive so it will not occur very rapidly.

3. Is there anything about the questions that you feel you do not understand? List your concerns/questions.

nothing

4. If there is one question you would like to have answered in lecture, what would that question be?

nothing

how to cal. Q, 2d, 2e