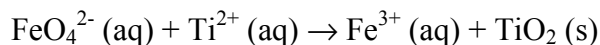
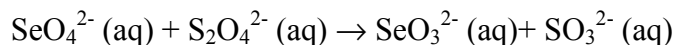


CHEM 121
Supplemental Questions for Electrochemistry

1a. Balance the following redox reaction that takes place in acidic solution. Identify the oxidant and the reductant.



b. Balance the following redox reaction that takes place in basic solution. Identify the chemical species that was reduced and the chemical species that was oxidized.



2. An electrochemical cell is constructed of one half-cell in which a silver wire is placed into a 1.00 M aqueous solution of AgNO_3 , and the other half-cell consists of a zinc electrode in an aqueous solution of $\text{Zn(NO}_3)_2$ that is also 1.00 M.

a. Write the balanced chemical equation for the spontaneous reaction that occurs in this cell under standard conditions.

b. What is E^0 for this cell?

c. What is ΔG^0 for this cell?

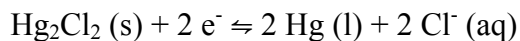
d. Write this cell in line notation (the short-hand way discussed in class).

e. What would be E for the cell at 35.0 °C when $[\text{Ag}^+]$ is 0.50 M and $[\text{Zn}^{2+}] = 1.00$ M?

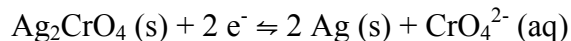
3. We have learned that the ionization energy decreases down a group. So, for the elements of Group 1, it should be easier to remove an electron from K than it is to remove an electron from Na and this is easier than removing an electron from Li. In other words, ΔG for the reaction: $\text{M} (\text{g}) \rightarrow \text{M}^+ (\text{g}) + \text{e}^-$ (where M is Li, Na, or K) should be more negative for K than Na, which is more negative than that of Li.

Consult the table of standard reduction potentials, and give the order of ΔG that it predicts for the reaction $\text{M} (\text{s}) \rightarrow \text{M}^+ (\text{aq}) + \text{e}^-$ (where M is Li, Na, or K). What have we forgotten to take into account that might fix the apparent incongruity between the order predicted by the ionization energies and that predicted by the E^0 ?

4. An electrochemical cell is constructed consisting of a saturated calomel electrode (SCE) in one compartment and a silver wire coated with Ag_2CrO_4 in the other compartment. The SCE is an electrode that is composed of liquid mercury in contact with a saturated solution of Hg_2Cl_2 (calomel), which is also saturated with KCl . The SCE is described by the half-reaction that is shown below, and it has E^0 of +0.2412 V versus SHE.



The E^0 for the following half-reaction is +0.466 V relative to SHE.



- Combine the two half-reactions to get the overall balanced chemical equation for the cell. Calculate E^0 and ΔG^0 for this cell (25.0 °C, $[\text{CrO}_4^{2-}] = 1.00 \text{ M}$).
- Write the Nernst equation for this cell. Assume that all of the concentrations associated with the SCE are 1.00 m.
- If the coated silver wire is placed in a solution at 25.0 °C in which $[\text{CrO}_4^{2-}]$ is $1.00 \times 10^{-5} \text{ M}$, what is the expected cell potential?
- Using data from this problem and the half-reaction shown below ($E^0 = +0.7994$), calculate K_{sp} for Ag_2CrO_4 .

