

Lesson 32: Electrochemistry II

text: 526-544

what to know:

- Gibb's function and cell voltages, standard states, §13-1
- standard half-cell reduction potentials. §13-2, (Omit disproportionation, p-534)
- how to write balanced equations for electrode reactions, predict spontaneity of redox reactions and calculate standard cell emfs using the standard reduction potential table, p-532
- oxidizing and reducing agents, §13-3
- effect of concentrations (Nernst Equation) on cell voltages (qualitative), pH meters, §13-4
- relationship of Gibb's free-energy, cell voltages and equilibrium constants (qualitative), §13-5

questions:

1. Consider a voltaic cell in which the half-cell reactions Mg/Mg^{2+} and Ag/Ag^+ are used.
 - a. What is the reducing agent?
 - b. What substance is reacting at the anode?
 - c. Write the overall balanced equation for the reaction occurring in the cell.
 - d. Calculate the standard cell voltage for the cell.
2. Consider the cell: $\text{Al} \mid \text{Al}^{3+}(\text{aq}, 1\text{M}) \mid \text{KCl}(\text{sat'd}) \mid \text{NO}(\text{g}) \mid \text{NO}_3^-(\text{H}^+) \mid \text{Pt}(\text{s})$
 - a. What is the oxidizing agent?
 - b. What substance is reacting at the cathode?
 - c. Write the balanced net ionic equation for the reaction.
 - d. What is the E_{cell}° for the reaction?
 - e. Would the E_{cell} for the reaction be (lower than, higher than, or unchanged from) E_{cell}° if the aluminum ion concentration was 2 M?
3. Given the reaction, $2\text{Au}(\text{s}) + 3\text{Ca}^{2+}(\text{aq}) \rightleftharpoons 2\text{Au}^{3+}(\text{aq}) + 3\text{Ca}(\text{s})$
 - a. What is the E_{cell}° for the reaction as written?
 - b. Is this reaction spontaneous?
4. Name:
 - a. a substance that will oxidize Fe^{2+} but not Br^- .
 - b. a halogen that will oxidize Cu but not Ag .
 - c. a substance that would oxidize Fe to Fe^{2+} but not to Fe^{3+} .
5. Which of the following:
 - a. would dissolve in nitric acid but not in hydrochloric acid under standard conditions?
Sn Hg Au Fe Mn Cu Cd Au
 - b. would oxidize Br^- to Br_2 ? I_2 , I, Cl_2 , Cl, Au^{3+} , Cu
 - c. is the strongest reducing agent? Al^{3+} , H_2 , Cl_2 , F^-
6. Relate ΔG° , E_{cell}° , and K_{eq} for redox reactions. If ΔG° is very negative, what do you know about the magnitude of E_{cell}° and K_{eq} ?
7. Consider the reaction, $\text{Zn}^{++} + \text{Cu} \rightleftharpoons \text{Cu}^{++} + \text{Zn}$. Is this reaction spontaneous under standard conditions? Under what conditions would it be spontaneous? Explain.
8. How does a pH meter work?