For more practice, go to the Problem Bank in Appendix D.

Introduction to Electrochemistry

SECTION 1 REVIEW

1. In the half-cell $Zn^{2+}(aq) + 2e^- \longrightarrow Zn(s)$, what is the electrode and is this half-reaction an anodic reaction or a cathodic reaction?
2. What role does the porous barrier play?
3. For each of the following pairs of half-cells, write the overall reaction and the cell notation. Assume the first half-cell given in each pair is the cathodic half-cell.
   a. Ag^+/Ag, Co^{2+}/Co
   b. Au^{3+}/Au, Zn^{2+}/Zn
   c. Hg^{2+}/Hg, K^+/K
4. Describe the components of an electrochemical cell and how the electrical charge travels through these components.

Voltaic Cells

SECTION 2 REVIEW

5. Describe a voltaic cell, and give two examples of a voltaic cell.
6. What is the essential advantage of a fuel cell over batteries in the generation of electrical energy?
7. Explain why corrosion is a voltaic cell.
8. Discuss the advantages and disadvantages of corrosion-prevention methods.
9. Which half reaction would more likely be an oxidation reaction: one with a standard reduction potential of −0.42 V, or one with a standard reduction potential of +0.42 V?
10. Why are dry-cell batteries called *dry cells,* even though their chemistry involves water?
11. a. Explain what is meant by the potential difference between the two electrodes in an electrochemical cell.
    b. How is this potential difference measured? What units are used?
12. The standard hydrogen electrode is assigned an electrode potential of 0.00 V. Explain why this voltage is assigned.

13. a. What information is provided by the standard reduction potential of a given half-cell?
    b. What does the relative value of the reduction potential of a given half-reaction indicate about its oxidation-reduction tendency?
14. When the cell $Ba(s)\,|\,Ba^{2+}(aq)\,||\,Sn^{2+}(aq)\,|\,Sn(s)$ is running, what observations can be made?

PRACTICE PROBLEMS

15. For each of the following pairs of half-cells, determine the overall electrochemical reaction that proceeds spontaneously:
    a. Na^+/Na, Ni^{2+}/Ni
    b. F_2/F^-, S/H_2S
    c. Br_2/Br^-, Cr^{3+}/Cr
    d. MnO_4^-/Mn^{2+}, Co^{2+}/Co
16. Determine the values of E^0 for the cells in the previous problem.
17. Suppose chemists had chosen to make the $I_2 + 2e^- \longrightarrow 2I^-$ half-cell the standard electrode and had assigned it a potential of zero volts.
    a. What would be the E^0 value for the $Br_2 + 2e^- \longrightarrow 2Br^-$ half-cell?
    b. What would be the E^0 value for the $Al^{3+} + 3e^- \longrightarrow Al$ half-cell?
    c. How much change would be observed in the E^0 value for the reaction involving $Br_2 + I^-$ if the I_2 half-cell is the standard?
18. If a strip of Ni were dipped into a solution of $AgNO_3$, what would be expected to occur? Explain, using E^0 values and equations.

Electrolytic Cells

SECTION 3 REVIEW

19. What reaction happens at the cathode in an electrolysis process?
20. Explain why water cannot be used in the electrochemical cell during the production of aluminum.
21. Calculate the voltage of a cell in which the overall reaction is the electrolysis of aqueous cadmium chloride into its elements.
22. According to electrochemical data, can Ni be plated onto a zinc metal object using a nickel nitrate solution? Explain.