

23.2

HALF-CELLS AND CELL POTENTIALS

SECTION REVIEW

Objectives

- Define standard cell potential and standard reduction potential
- Use standard reduction potentials to calculate standard cell potential

Key Terms

- electrical potential
- reduction potential
- cell potential
- standard cell potential
- standard hydrogen electrode

Key Equation

$$E_{\text{cell}}^0 = E_{\text{red}}^0 - E_{\text{oxid}}^0$$

Part A Completion

Use this completion exercise to check your understanding of the concepts and terms that are introduced in this section. Each blank can be completed with a term, short phrase, or number.

The measure of a voltaic cell's ability to produce an electric current is called its 1, which is usually measured in volts. The electrical potential of a cell results from a competition for 2 between the two half-cells. The half-cell with the greatest reduction potential is the half-cell with the greatest tendency to acquire 3; it will be the half-cell where 4 occurs. The difference between the reduction potentials of the two half-cells is called the 5.

In comparing standard cell potentials for half-reactions, the 6 serves as a reference and is assigned a value of 7. A negative value for the standard reduction potential means that the tendency for this half-cell to be reduced is 8 than the tendency for hydrogen ions to be reduced. If the calculated standard cell potential for a given redox reaction is positive, then the reaction is 9.

Part B True-False

Classify each of these statements as always true, AT; sometimes true, ST; or never true, NT.

- _____ 10. The half-cell that has a greater tendency to acquire electrons will be the one in which oxidation occurs.
- _____ 11. In an electrochemical cell, the hydrogen half-cell is the reduction half-cell.
- _____ 12. A positive value for a standard reduction potential means hydrogen ions have a greater tendency to be reduced than the ions in this half-cell.
- _____ 13. If the cell potential for a given redox reaction is negative, the reaction is spontaneous.

Part C Matching

Match each description in Column B to the correct term in Column A.

Column A

Column B

- | | |
|--------------------------------|--|
| _____ 14. electrical potential | a. the difference between the reduction potentials of the two half-cells |
| _____ 15. reduction potential | b. the measure of a cell's ability to produce an electric current |
| _____ 16. spontaneous reaction | c. the standard reduction potential of the hydrogen electrode |
| _____ 17. 0.00 V | d. the tendency of a given half-reaction to occur as a reduction |
| _____ 18. cell potential | e. standard reduction potential for the oxidation half-cell |
| _____ 19. E_{oxid}^0 | f. a reaction known to give the products as written in the balanced equation |

Part D Questions and Problems

Answer the following in the space provided.

20. Compute the standard cell potential of a $\text{Mg} | \text{Mg}^{2+} || \text{Cl}_2 | \text{Cl}^-$ cell using standard electrode potentials.