

CHAPTER 19 LEARNING OBJECTIVES

To satisfy the minimum requirements for this course, you should master the following learning objectives.

Recognize a redox reaction and be able to:

- assign oxidation numbers to atoms in molecules and ions.
- write the oxidation and reduction half reactions.
- identify the oxidizing agent and reducing agent.
- balance any redox reaction.

Understand the functions of the various components of simple voltaic and electrolytic cells.

Diagram cells, labeling the anode, cathode, directions of ion and electron movement.

Understand the definitions of and relationships among the important quantities: electrical work, electrical charge, electrical current, and electrical potential (“emf”, potential energy difference).

Given appropriate reduction potentials,

- calculate the cell voltage (standard cell potential, E°_{cell}) generated by a voltaic cell.
- determine the relative strengths of oxidizing or reducing agents.
- use standard reduction potentials to predict whether a given reaction will be spontaneous when all of the reactants and products are present in their standard states (under standard conditions).

Interconvert E°_{cell} , ΔG° , and K for oxidation-reduction reactions.

Use the Nernst equation to calculate the cell potential or the concentration of an ion, under nonstandard conditions.

Discuss how a spontaneous redox reaction can be used to create a battery and:

- recognize the connection between the components of the cell and the properties of the battery.
- recognize the chemical reaction used in a lead-acid storage battery.
- describe the basic components and processes in fuel cells.

Discuss the difference between galvanic and electrolytic cells and:

- given appropriate electrode potentials, predict the likely electrolysis reactions in aqueous solutions, and calculate the minimum potential required to cause electrolysis in aqueous solutions.
- interrelate time, current, and the amount of substance produced/consumed in an electrolysis reaction.

Describe corrosion in terms of the electrochemistry involved, and explain the principles that underlie cathodic protection. Describe methods for minimizing corrosion, for Naval vessels.

Understand the meaning of the Key Words on page 873.