

CHAPTER 7

Toys for Understanding

Chapter Overview

Chapter Challenge

Students are asked to design a toy that includes a motor, a generator, or both and provide instructions on how to operate the toy. Their toy has to illustrate how electricity can be produced from an energy source such as wind, moving water, a falling weight, or some other external source. The instructions students develop include an explanation of how to assemble and operate the toy, as well the basic physics on how and why it works.

As students read the *Chapter Challenge*, the requirements of designing a toy might appear difficult at first. Reassure them that as the chapter progresses, they will continue to build on prior concepts and by the end should have enough understanding of the concepts of electricity, magnetism, and the interaction between the two to be able to successfully complete the challenge. Geared toward a progressive understanding of concepts, students are asked to reflect at the end of each section and consider what it means for the challenge.

The criteria for the challenge and a rubric for assessing student performance should be determined with the class. The grading criteria should include factors such as the quality and safety of the toy, what the generator and/or motor are made of, how visible they are, a set of age-appropriate instructions that include how and why the toy works based on basic physics principles, how to assemble it and use it, and considerations of how the toy will amuse and interest a child.

Chapter Summary

Students investigate and apply ideas involving electricity, magnetism, electromagnetism, motors, generators, and electromagnetic waves.

Students will:

- investigate the magnetic interaction and map a magnetic field.
- investigate the interaction between an electric current and a magnetic field.
- investigate electromagnets and solenoids, and determine the variables that affect the strength of the magnetic field produced.
- describe magnetic domains.
- explain the interaction between a current-carrying wire and a magnet using magnetic fields.
- build, operate, and explain a motor, and identify ways to improve its performance.
- identify common appliances that use a motor.
- investigate and explain the interaction between a moving magnet and a coil of wire.
- explain how a galvanometer works.
- describe and explain AC and DC generators.
- describe the relationship between electric and magnetic fields.
- identify patterns between changing electric and magnetic fields.
- describe electromagnetic waves, the electromagnetic spectrum, and the speed of light.
- calculate the distance traveled by electromagnetic waves.