

# CHAPTER 2

## Physics in Action

### Chapter Overview

#### Chapter Challenge

This chapter introduces Newton's laws of motion and the concepts of force, inertia (mass), friction, center of mass, work, and energy. The *Chapter Challenge* asks students to produce a two-to-three minute voice-over narration for a sports video explaining the physics behind a sporting event. The students are expected to go beyond the usual description of the event to give the viewer a broader perspective on both sports and the physics involved in that sport. They have to explain the rules of nature that describe the event. The narration can be dubbed into the soundtrack, recorded in an audio version, or provided live. They are also required to submit a written script of the narration.

Students might find it hard to meet the challenge of preparing a scientific documentary. Reassure them that as the concepts in the chapter become more familiar they will be better prepared to complete such an assignment. Remind them that this assignment could be their tryout for a broadcasting job. By the end of the chapter, they will have the skills and knowledge necessary to succeed. The *Chapter Challenge* is designed to set the stage for the physics principles that will be analyzed as the chapter progresses.

You should read the requirements of the challenge along with your students, making sure that students understand exactly what is expected of them. You may select several videos for the students to choose from, or if your students are very ambitious, they can either find some footage themselves or shoot some scenes with a camcorder, or record some sporting events from TV. The entire chapter will build toward the *Chapter Challenge*, and the final evaluation of the students' progress will be based on the video voice-over.

#### Chapter Summary

The students develop and present a voice-over narration of a sports scene describing the physics involved in the athletes' feats to demonstrate their knowledge of the science involved. Students

- investigate Galileo's law of inertia and Newton's first law of motion, and relate how the laws apply to sporting events.
- explore the terms positive acceleration, negative acceleration, and average speed.
- describe the concept of weight and inertia, and apply Newton's second law of motion.
- recognize that a projectile's vertical motion is independent of its horizontal velocity.
- construct models of trajectories launched at various angles.
- explore Newton's third law of motion and learn the concept of center of mass.
- investigate how the coefficient of sliding friction affects motion.
- describe the law of conservation of energy and define work.
- calculate energy at three different positions of an athlete's jump.