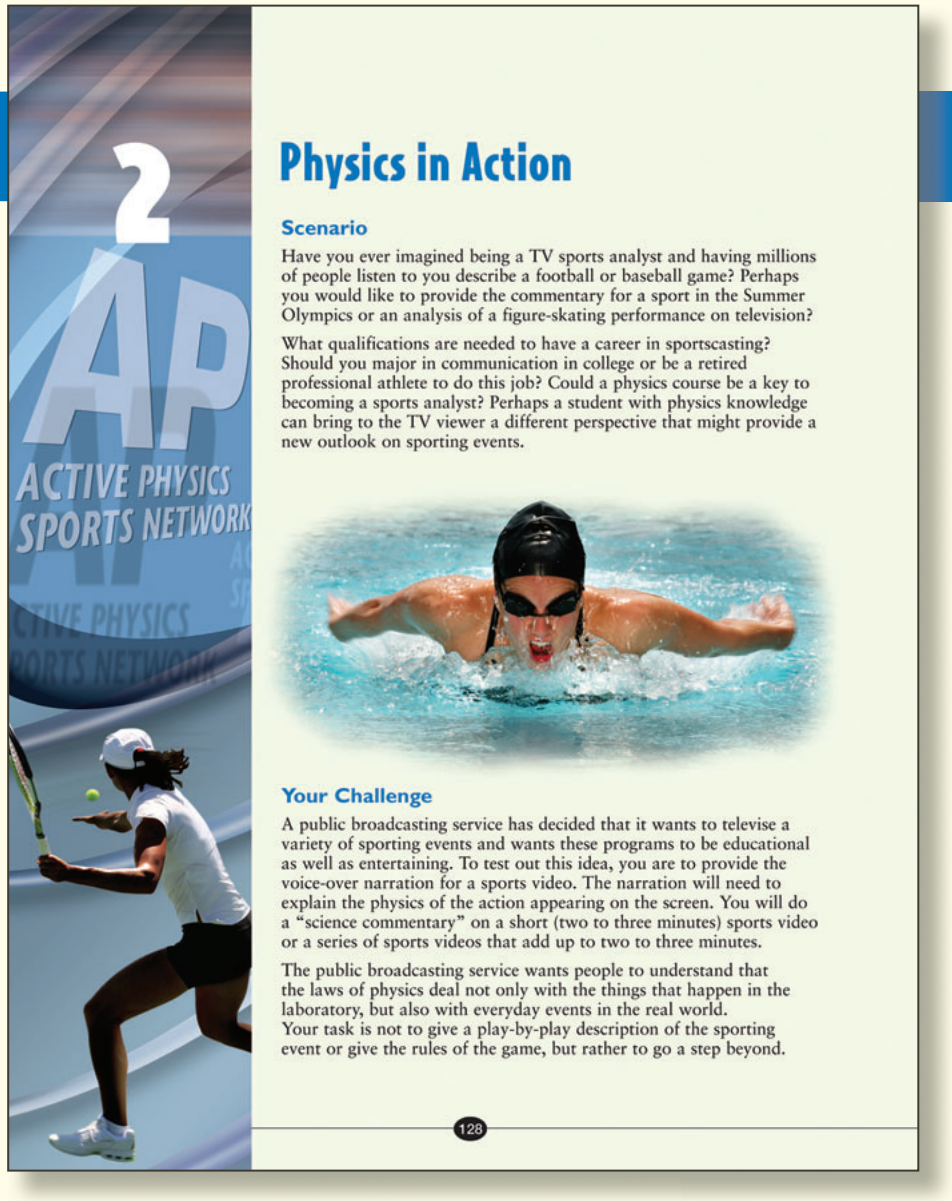
Chapter Challenge



Scenario

Read or have students read the *Scenario* aloud. Have students review the table of *Contents*. You may wish to show them a sports video with a commentary. You might even ask them to describe what they see in a sports video that doesn't have a commentary. In doing so, the students will begin to realize what they need to know about the sport for which they choose to provide a voice-over. Suggest to the students that an analysis of a sport would also help them in their presentation and appreciation of the sport.

To elicit an effective science commentary, remind students that each section corresponds to the physics concepts they will need to understand. Emphasize that the skills and knowledge required to perform the culminating task will accumulate gradually as they go through each section. Suggest strategies, such as using a concept map or keeping an updated record of information in *Active Physics* logs, to incorporate new vocabulary that enriches each student's performance.

Your Challenge

Lead a class discussion to tell your students that there are a number of objectives in this chapter, one of which is that the laws of physics hold true not only in their science class and lab, but also in the outside world. The students should be able to look at a sporting event and realize what physical principle is involved. Hopefully this will carry over to everyday life, and the students will then be able to see the physics in the world around them. Each class might start with a short video segment showing sports bloopers. They are commercially available and many of the students may have their own. After the class has covered some of the material, it is increasingly appropriate to discuss the physics displayed in the blooper. Many of these bloopers are very humorous, and will make students look forward to the beginning of the class.

The main concern of this chapter is to ensure that students become well acquainted with the principle of inertia, Newton's laws, and frames of reference. The *Physics to Go* at the end of each section


You are to educate the audience by describing to them the rules of nature that govern the event. This approach will give the viewer (and you) a different perspective on both sports and physics.

You can think of this narration as a tryout for a broadcasting job. In this tryout, a traditional sports broadcaster will give the play-by-play and then turn the microphone over to you to give the physics of sports overview. You can provide the narration live, dub it onto the video soundtrack, or record an audio version. You will also need to submit a written script of the narration.

Criteria for Success

What criteria should be used to evaluate a voice-over narration or script of a sporting event? Since the intention is to provide an interesting analysis of the physics of sports, the voice-over should include the use of physics terms and physics principles. However, remember that physics principles are not enough. Your voice-over narration will also need to be entertaining.

Work with your class to develop a set of criteria for a successful voice-over narration. When you have decided what is required, compare your list with the list on the following page.

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often contains more questions than those that are required to be assigned for homework. This section has been written in a way that gives you a choice of how much work, and the nature of work, the students will be expected to do each day out of class. As you work with *Active Physics*, be aware that the same physics concepts appear repeatedly in different contexts. It is not necessary for the students to achieve total understanding the first time they encounter a new concept.

Criteria for Success

Develop a set of criteria for assessment in the *Chapter Challenge* together with your class. You should get students' feedback on the details that should be included in their sports commentary and what criteria would form a relevant assessment. The criteria should be clear and easy to follow and carry frequent references to the physics principles that the students will study. While developing the criteria, be accurate and concise. The students should be able to comprehend the criteria with ease.

If you ask your class to volunteer their suggestions for evaluating the *Chapter Challenge*, they will relate to the assessment with a sense of ownership. Make a list of the criteria on the board and solicit student opinion frequently, so that the evaluation can be written in a style that students understand. Some of the main questions you should ask are—How many physics terms should be included? How much description should the science commentary carry and for how long? Have the physics terms been integrated appropriately? After a discussion of the criteria, you and your class should assign points to each criterion.

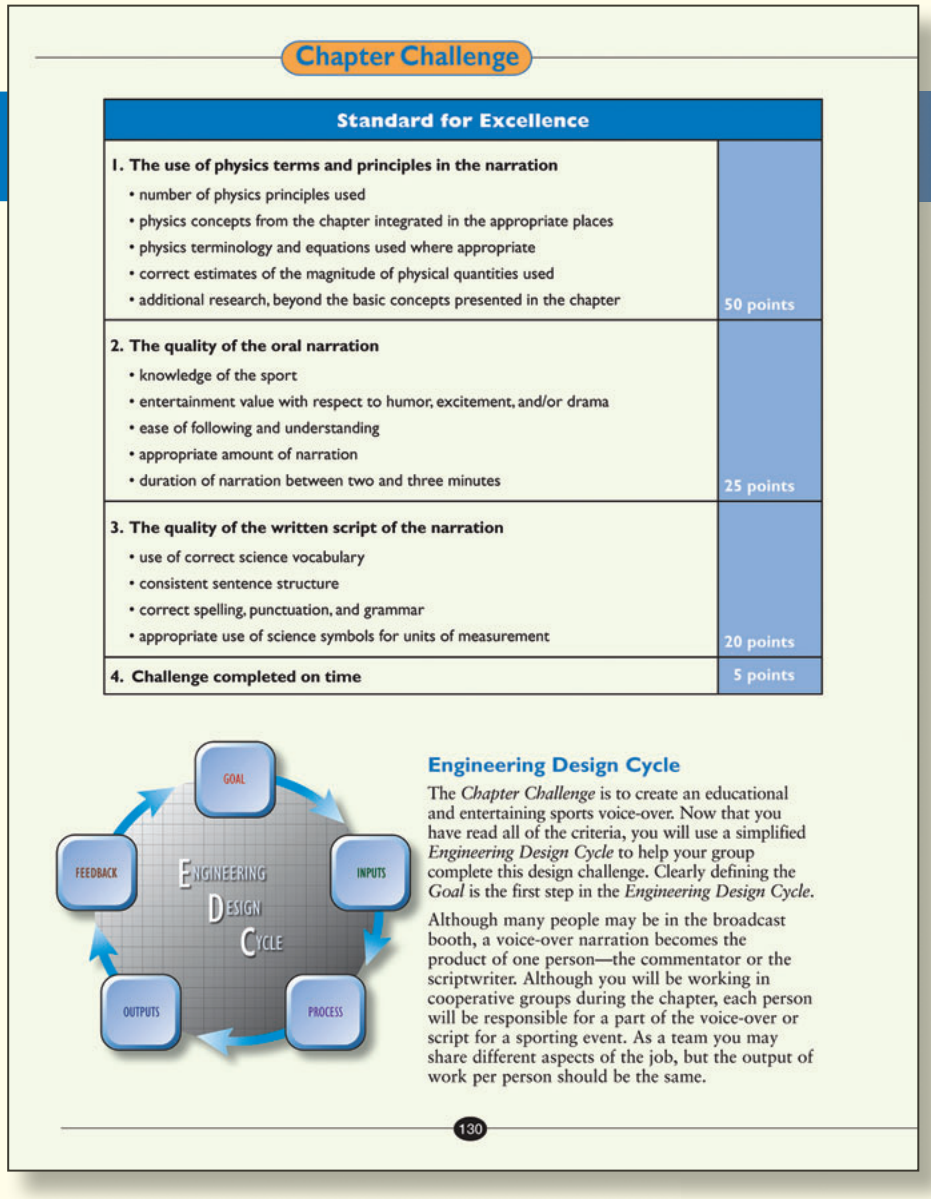
Have a 10-minute discussion with your class on the criteria that you and your class select. Once you've decided on the final criteria for assessment, use it as a scoring guide to ensure that student expectations are met consistently. You might wish to modify the final assessment criteria to fit state standards and benchmarks. Keep in mind that all expectations should be communicated to the students before you begin work on this chapter.

Chapter Challenge

Standard for Excellence

Students should be able to decide the criteria for evaluating their *Chapter Challenge*. You can facilitate the process of determining each criterion by providing an outline of standards they will be covering. Students do not have to begin with a final assessment rubric. Emphasize that the class will have a chance to reflect on the rubric as it proceeds further in the chapter. At this stage, students should focus on the broader aspects of assessment relevant to the final project. Discuss the list of sample criteria in the student text of *Active Physics*.

A sample rubric is provided at the end of this chapter. The criteria required to meet the standards of excellence should be clearly defined. Students must understand how each column of the grading rubric, which assigns a grade, differs in its expectations. As the chapter progresses, so should the rubric. At each stage of the rubric's development, students should be given a voice, empowering them to assess their own work. This will instill in them a sense of ownership and self-confidence. To make sure that all important aspects have been covered, introduce a new criterion, then with discussion, establish its significance by asking specific questions. The purpose of the criteria should be highlighted and properly understood so that students know how they can excel in the final project. The *Standard for Excellence* table is provided as a Blackline Master in your *Teacher Resources CD*.



Chapter Challenge

Standard for Excellence	
1. The use of physics terms and principles in the narration • number of physics principles used • physics concepts from the chapter integrated in the appropriate places • physics terminology and equations used where appropriate • correct estimates of the magnitude of physical quantities used • additional research, beyond the basic concepts presented in the chapter	50 points
2. The quality of the oral narration • knowledge of the sport • entertainment value with respect to humor, excitement, and/or drama • ease of following and understanding • appropriate amount of narration • duration of narration between two and three minutes	25 points
3. The quality of the written script of the narration • use of correct science vocabulary • consistent sentence structure • correct spelling, punctuation, and grammar • appropriate use of science symbols for units of measurement	20 points
4. Challenge completed on time	5 points

Engineering Design Cycle

The *Chapter Challenge* is to create an educational and entertaining sports voice-over. Now that you have read all of the criteria, you will use a simplified *Engineering Design Cycle* to help your group complete this design challenge. Clearly defining the *Goal* is the first step in the *Engineering Design Cycle*.

Although many people may be in the broadcast booth, a voice-over narration becomes the product of one person—the commentator or the scriptwriter. Although you will be working in cooperative groups during the chapter, each person will be responsible for a part of the voice-over or script for a sporting event. As a team you may share different aspects of the job, but the output of work per person should be the same.

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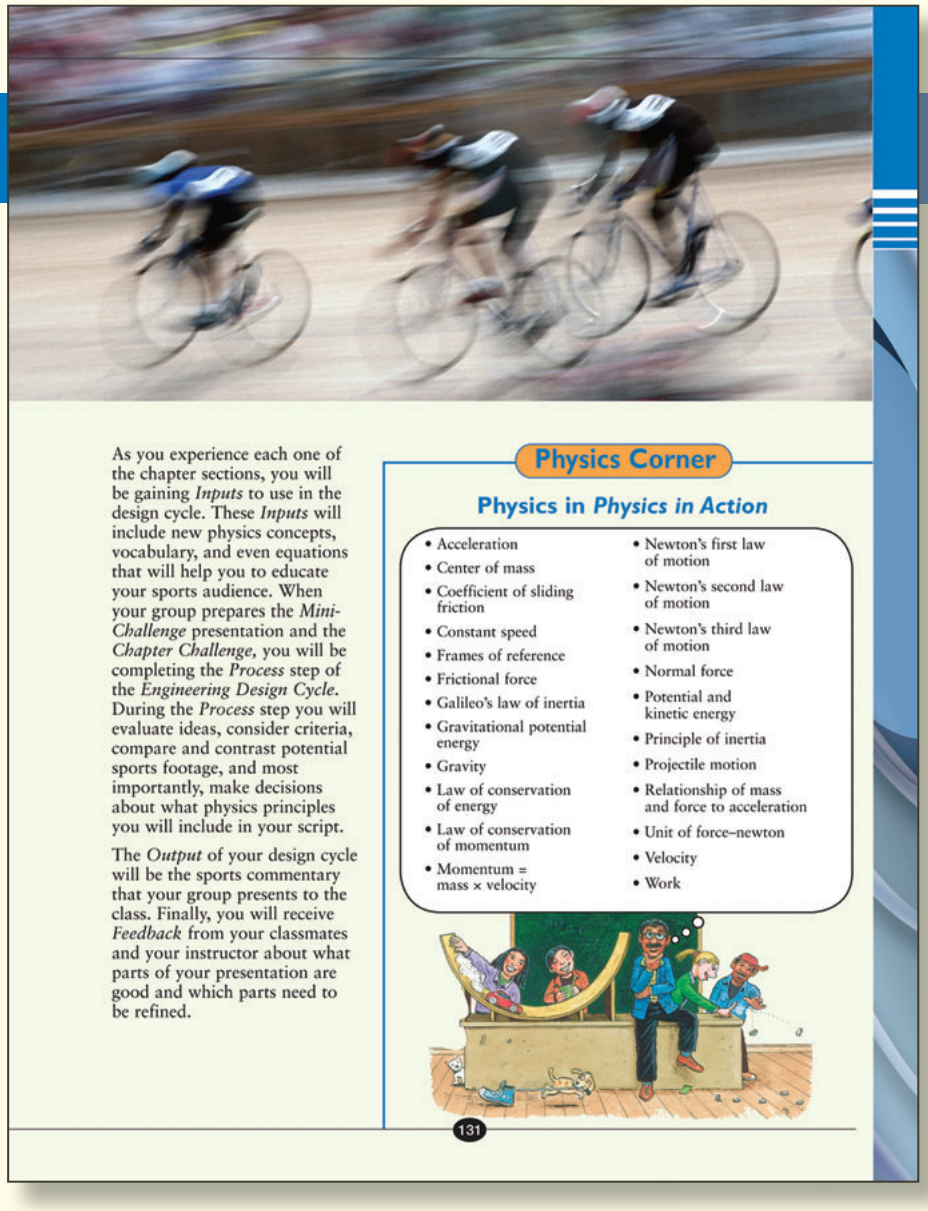
2a **Blackline Master**

Engineering Design Cycle

Consider introducing the *Engineering Design Cycle* with an overhead projector. Draw attention to the different phases of the cycle by examining each phase. As students read this section, ask them to highlight the purpose of each step. Explain how the *Chapter Challenge* is built upon a series of steps



As you experience each one of the chapter sections, you will be gaining *Inputs* to use in the design cycle. These *Inputs* will include new physics concepts, vocabulary, and even equations that will help you to educate your sports audience. When your group prepares the *Mini-Challenge* presentation and the *Chapter Challenge*, you will be completing the *Process* step of the *Engineering Design Cycle*. During the *Process* step you will evaluate ideas, consider criteria, compare and contrast potential sports footage, and most importantly, make decisions about what physics principles you will include in your script.

The *Output* of your design cycle will be the sports commentary that your group presents to the class. Finally, you will receive *Feedback* from your classmates and your instructor about what parts of your presentation are good and which parts need to be refined.

Physics Corner

Physics in *Physics in Action*

- Acceleration
- Center of mass
- Coefficient of sliding friction
- Constant speed
- Frames of reference
- Frictional force
- Galileo's law of inertia
- Gravitational potential energy
- Gravity
- Law of conservation of energy
- Law of conservation of momentum
- Momentum = mass × velocity
- Newton's first law of motion
- Newton's second law of motion
- Newton's third law of motion
- Normal force
- Potential and kinetic energy
- Principle of inertia
- Projectile motion
- Relationship of mass and force to acceleration
- Unit of force–newton
- Velocity
- Work

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Physics Corner

This section previews the concepts the students will be studying. You may wish to know how many of these terms are familiar to your students. When the chapter ends, you might want to revisit the concepts from time to time to chart each student's progress in understanding new terms and principles. What is most important is that students should retain the new concepts they have learned.

Encourage each student to keep a record in their logs of the new terms they learn. Have them chart connections of physics concepts to events that happen in their daily lives, especially in the sports they play. You may want to begin your class with a meaningful concept linked to the daily routine of an individual.

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that continue to complement each other in a cyclical pattern. You might want to emphasize that each phase of the cycle is experienced as students progress through the chapter. New concepts are developed and understood gradually. The *Inputs* of the *Engineering Design Cycle* incorporate new concepts and vocabulary. The *Process* evaluates, compares, and contrasts the physics principles through the *Chapter Mini-Challenge* and the *Chapter Challenge*. While the *Outputs* take shape in the form of a final product, the *Feedback* continues to be a useful tool in providing a constructive peer analysis of the *Goal*.