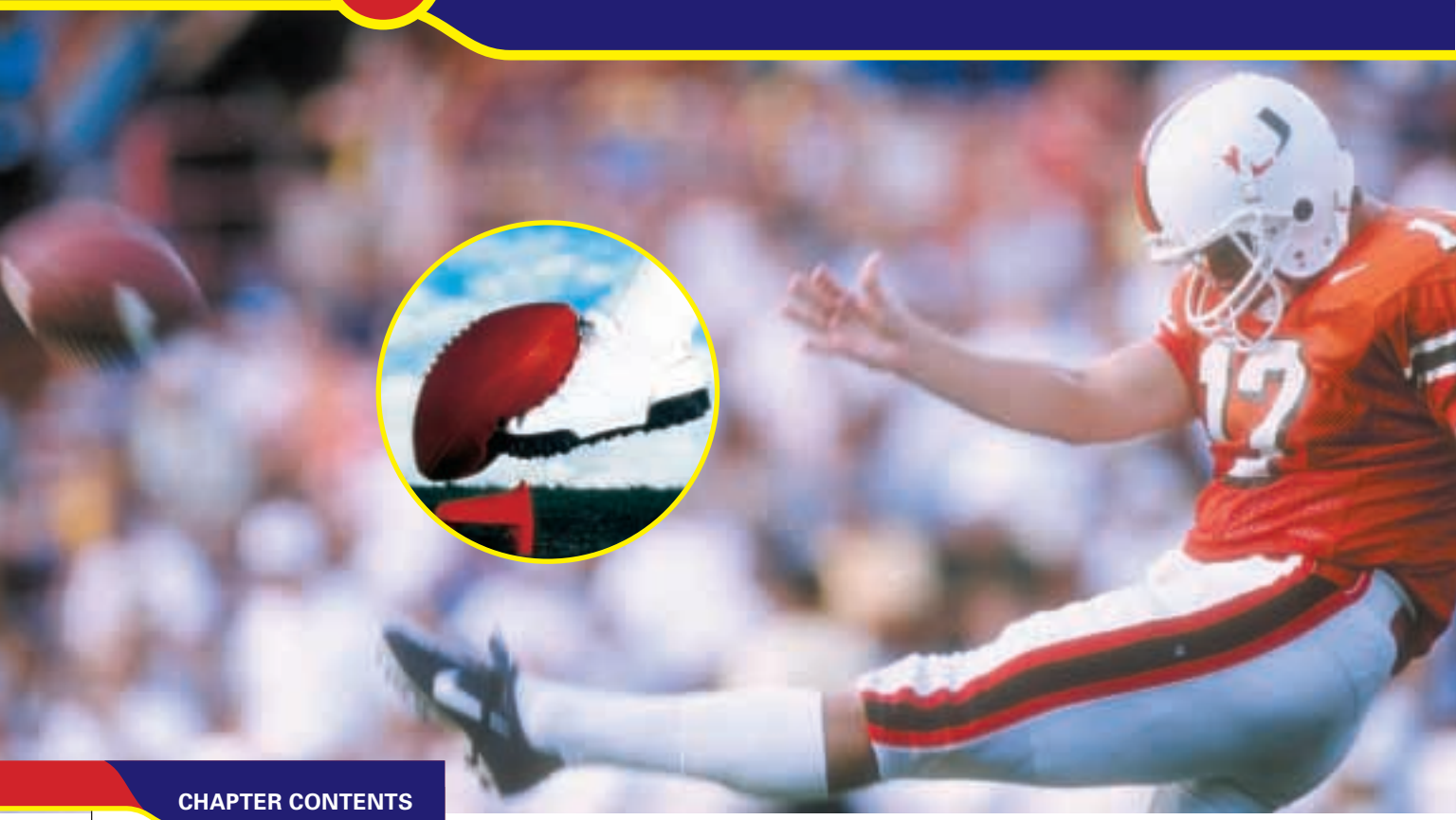
CHAPTER 6

Work, Power, and Efficiency



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A football flies through the air. The kicker's foot has just done work on the football, causing it to seemingly defy gravity as it soars high above the field. The kick returner anxiously waits as the ball falls faster and faster toward his arms. The opposing team bears down on him as rapidly as the ball descends. Catching the ball, he runs about six yards. Then you hear the clash of helmets as the opposing tackles bring him to the ground. Although you cannot actually see the energy that has been transferred to the ball and among the players, you most certainly can see and even hear its effects. By simply using your own five senses, you can witness the effects of energy and energy transformations.

Although it may not be obvious, every object you see has some form of energy. When you observe people walking, curtains blowing in the breeze, a jet plane in the distance, or hear the quiet humming of a computer fan, you are detecting evidence of energy transformations. In this chapter, you will learn to understand and describe, both conceptually and mathematically, some important types of energy transformations.

MULTI LAB

Sources of Energy

TARGET SKILLS

- **Predicting**
- **Analyzing and interpreting**
- **Communicating results**

Hit a Block

Suspend a mass on a string as shown in the photo. Keeping the string taut, pull the mass upward away from the block. Release the mass so it is free to swing down and strike the stationary block. Predict how varying the height of the mass will affect the motion of the block after it is hit by the mass. Repeat the procedure several times, holding the mass at different heights.

Analyze and Conclude

1. What force causes the mass to swing?
2. Using technical terms, write a statement that describes the relationship between the height of the block and the resulting motion of the mass.

Wind-Up Toy

Your task is to develop a relationship between the number of turns used to wind a toy car and the distance the toy travels. Devise a method to ensure that the toy travels in a straight line.

Analyze and Conclude

1. How is energy stored in the toy when you wind it up?
2. What causes the toy to move?
3. What force causes the toy to stop?
4. Make a general statement about the number of winding turns and energy.
5. Make a general statement about the number of winding turns and the distance travelled.
6. What happened to the stored energy?

Come-Back Can

Obtain a hammer, two nails, one elastic band, a coffee can, tape, and items to act as weights. Attach your weights to *one* side of the elastic band with a string. Punch a hole in the centre of the plastic lid and the bottom of the can. Slip the elastic band through each hole. Ensure that the weights are in the centre of the elastic band. Put a nail through the loop of the elastic band and securely tape everything in place.

Analyze and Conclude

1. On a smooth, flat surface, gently roll the can away from yourself.
2. Release the can and describe what happens.
3. Suggest an explanation for what you observed.