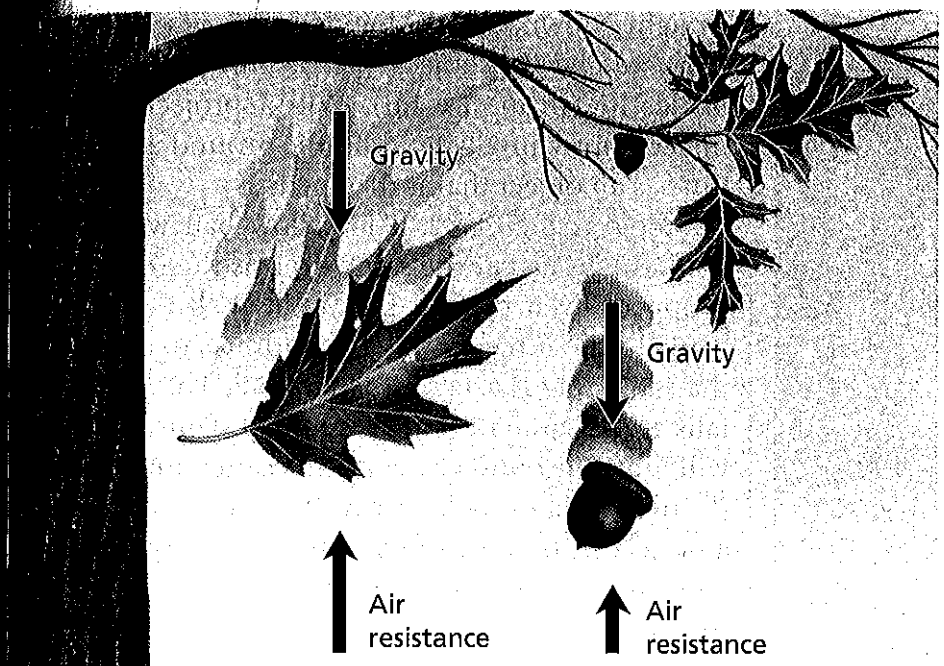

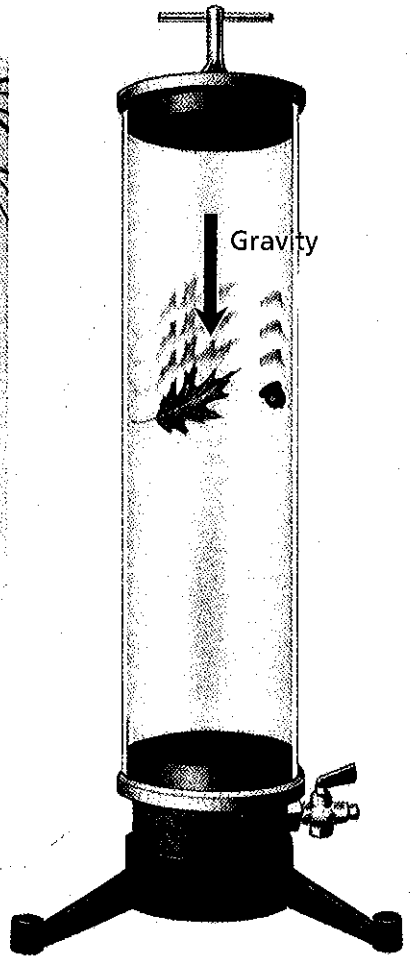

FIGURE 11
Air Resistance
Falling objects with a greater surface area experience more air resistance. If the leaf and the acorn fall from the tree at the same time, the acorn will hit first. **Comparing and Contrasting** *If the objects fall in a vacuum, which one will hit first? Why?*

Air Resistance Despite the fact that all objects are supposed to fall at the same rate, you know that this is not always the case. For example, an oak leaf flutters slowly to the ground, while an acorn drops straight down. Objects falling through air experience a type of fluid friction called **air resistance.** Remember that friction is in the direction opposite to motion, so air resistance is an upward force exerted on falling objects. Air resistance is not the same for all objects. Falling objects with a greater surface area experience more air resistance. That is why a leaf falls more slowly than an acorn. In a vacuum, where there is no air, all objects fall with exactly the same rate of acceleration.

You can see the effect of air resistance if you drop a flat piece of paper and a crumpled piece of paper at the same time. Since the flat paper has a greater surface area, it experiences greater air resistance and falls more slowly. In a vacuum, both pieces of paper would fall at the same rate.

Air resistance increases with velocity. As a falling object speeds up, the force of air resistance becomes greater and greater. Eventually, a falling object will fall fast enough that the upward force of air resistance becomes equal to the downward force of gravity acting on the object. At this point the forces on the object are balanced. Remember that when forces are balanced, there is no acceleration. The object continues to fall, but its velocity remains constant. The greatest velocity a falling object reaches is called its **terminal velocity.** Terminal velocity is reached when the force of air resistance equals the weight of the object.