Effect of the air on falling objects

As you are probably aware, and as may have been pointed out in your class, here on the Earth, objects do not always fall at the same rate of increasing speed. For instance, if you were to drop a hammer and a feather at the same time, the hammer would clearly reach the ground first, while the feather would 'float' down much more slowly. However, this is not because of any change in the way the gravitational interaction affects these objects, but because of the influence of another interaction; that of the falling objects with the air.

As an object moves through the air, it has to push the air in front of it out of the way. As it does so, the air then exerts a force back on the object in the opposite direction to its motion. Scientists call this force 'air resistance' or 'drag' and its strength depends on two factors; the surface area of the part of the object that is pushing on the air, and how fast the object is moving through the air.

To think about the effect of speed on the strength of air resistance imagine traveling in a car and holding your hand out the window, with your palm facing the direction the car is moving. You would feel the force of the air against your hand. As the car speeds up, the air would press harder against your hand, suggesting that the strength of the air resistance force increases with speed.

You can easily demonstrate the influence of surface area with a simple experiment. Take two identical sheets of paper and 'scrunch' one of them up into a small ball. Now hold both pieces of paper at the same height above the ground and release them simultaneously.

Which piece of paper reaches the ground first, the flat sheet or the 'ball'? Why do you think this is?

The force of air resistance has a much more significant effect on very light objects, with a large surface area, such as feathers, leaves, and sheets of paper. It is the influence of this force that causes such objects to 'float' downwards as they fall. In an environment in which there is little or no air, a hammer and a feather would fall at the same rate of increasing speed, and reach the ground together. (Your instructor may show you a demonstration or movie to illustrate this.)

Source: http://cpucips.sdsu.edu/web/pset/assets/c3aB.pdf