

## Air Resistance

Air resistance can benefit us, or it can get in the way. Either way, it is a fact of life. When an object passes through air, the air particles need to move out of the way for the object to pass. Air pushing against the moving object produces resistance or **drag**. Normally, the effect of air resistance is so small that we don't notice it. The faster the object moves, however, the greater the resistance is. Stick your hand out the window of a moving car, and you'll feel the resistance. This resistance costs motorists time and money. An object falling through the air speeds up because of gravity. This increases the air resistance. When the air resistance equals the gravitational pull, the net force is zero, and the object stops accelerating. Then the object falls at a constant speed called **terminal velocity**. The acceleration due to gravity is the same for all objects, but air resistance is not. A falling leaf floats slowly through the air. This is because its large surface interacts with a large number of air molecules. Parachute jumpers depend on this to land safely.

If the force of the air resistance on a falling object is known, the affect on its acceleration can be determined.



### Sample Problem

What is the acceleration of a 2.0 kg object falling through air if the air resistance is 3.0 N?

**Step 1:** Determine the weight of the object

$$F = ma = (2.0\text{kg})(9.8\text{m/s}^2) = 19.6\text{N}$$

**Step 2:** Determine the net force on the object

$$F_{\text{net}} = F_{\text{weight}} - F_{\text{air resistance}} = 19.6\text{N} - 3.0\text{N} = 16.6\text{N}$$

**Step 3:** Determine the acceleration

$$a = \frac{F_{\text{net}}}{m} = \frac{16.6\text{N}}{2.0\text{kg}} = 8.3\text{m/s}^2$$

Answer the questions below based on your reading and the sample problem above.

1. Trucks today generally have an airfoil. In the past they didn't. (See the picture to the right.) What is the airfoil for? \_\_\_\_\_



2. A leaf and an acorn fall from the same branch of an oak tree at the same time. Which will land first? Explain. \_\_\_\_\_
3. A piece of space junk is falling through the air at a constant speed of 55 m/s. Why isn't it speeding up if it is being pulled down by gravity? \_\_\_\_\_
4. What is the acceleration of a 15 kg object falling through air if the air resistance is 42 N?