

The Elephant and the Feather

Study the two animations from the **Multimedia Physics Studios**

<http://www.physicsclassroom.com/mmedia/newtlaws/efff.html>

<http://www.physicsclassroom.com/mmedia/newtlaws/efar.html>

MOP Connection: Newton's Laws: sublevels 10 and 11

Without Air Resistance

Suppose that an elephant and a feather are dropped off a very tall building from the same height at the same time. Suppose also that air resistance could be eliminated such that neither the elephant nor the feather would experience any air drag during the course of their fall. Which object - the elephant or the feather - will hit the ground first? Many people are surprised by the fact that in the absence of air resistance, the elephant and the feather strike the ground at the same time. Why is this so? Test your understanding by identifying the following statements as being either True (T) or False (F).

- _____ 1. The elephant and the feather each have the same force of gravity.
- _____ 2. The elephant has more mass, yet they both experience the same force of gravity.
- _____ 3. The elephant experiences a greater force of gravity, yet both the elephant and the feather have the same mass.
- _____ 4. On earth, all objects (whether an elephant or a feather) have the same force of gravity.
- _____ 5. The elephant weighs more than the feather, yet they each have the same mass.
- _____ 6. The elephant clearly has more mass than the feather, yet they each weigh the same.
- _____ 7. The elephant clearly has more mass than the feather, yet the amount of gravity (force) is the same for each.
- _____ 8. The elephant has the greater acceleration, yet the amount of gravity is the same for each.

With Air Resistance

Now consider the realistic situation that both feather and elephant encounter air resistance. Which object - the elephant or the feather - will hit the ground first? Most people are not surprised by the fact that the elephant strikes the ground before the feather. But why does the elephant fall faster? Test your understanding by identifying the following statements as being either True (T) or False (F).

- _____ 1. The elephant encounters a smaller force of air resistance and therefore falls faster.
- _____ 2. The elephant has the greater acceleration of gravity and therefore falls faster.
- _____ 3. Both elephant and feather have the same force of gravity, yet the acceleration of gravity is greatest for the elephant.
- _____ 4. Both elephant and feather have the same force of gravity, yet the feather experiences a greater air resistance.
- _____ 5. Each object experiences the same amount of air resistance, yet the elephant experiences the greatest force of gravity.
- _____ 6. Each object experiences the same amount of air resistance, yet the feather experiences the greatest force of gravity.
- _____ 7. The feather weighs more, and therefore will not accelerate as rapidly as the elephant.
- _____ 8. Both elephant and feather weigh the same amount, yet the greater mass of the feather leads to a smaller acceleration.
- _____ 9. The elephant experiences less air resistance and reaches a larger terminal velocity.
- _____ 10. The feather experiences more air resistance and thus reaches a smaller terminal velocity.
- _____ 11. The elephant and the feather encounter the same amount of air resistance, yet the elephant has a greater terminal velocity.