# Skydiving

## Getting Ready

Navigate to the Skydiving Interactive at TPC (http://www.physicsclassroom.com).

Home Page ==> Physics Interactives ==> Newton's Laws ==> Skydiving

Click/tap the **Launch Interactive** button.

## Getting Acquainted:

Experiment with the interface until you become comfortable using it. There are two choices for falling objects – a can of frosting and a gold brick. They can fall with or without a parachute. The parachute can be added at any time; you have two options - a large or a small parachute. You can position the falling object by dragging it to a starting position as high as 490 meters. The left side of the window displays a **Force Diagram** and a **Velocimeter**.

## Explore

Use the Interactive to explore the following questions:

1. Drop a **gold brick** from a height of **490 meters**. Use some carefully-chosen words and a couple of good sentences to describe the speed of the brick during the falling motion. (**NOTE**: The speed is the absolute value of the velocimeter reading.)

2. Describe how the amount of **Air Drag** changes over the course of the fall.

3. Note that the brick's speed eventually becomes constant. This constant speed value that the brick attains is known as the **terminal speed**. How do the two forces compare to one another when the terminal speed is reached by the brick?

**Force Diagram**

In the space at the right, draw the force diagram for this *terminal speed moment*.

4. Run some trials to determine the terminal speed value for the two different objects – without a parachute, with a small parachute, and with a large parachute.

| | Terminal Speed (m/s) for Several Conditions | | |
|---|---|---|---|
| | **No Parachute** | **Small Parachute** | **Large Parachute** |
| **Gold Brick** | | | |
| **Can of Frosting** | | | |

5. Describe how the weight of the falling object affects the terminal speed.

6. Describe how the parachute size affects the terminal speed. Propose a theoretical reason for this cause-effect relationship.

7. Drop a gold brick from 490 meters. Once the brick reaches terminal speed, add a large parachute. Describe the sequence of changes that occur - immediately and over the course of time – after the parachute is added.

8. Draw four Force Diagrams showing the relative size of the forces for Question #7.

| No Parachute (@ term. speed) | Large Parachute (immediately after adding) | Large Parachute (~1 second after adding) | Large Parachute (just before landing) |
|---|---|---|---|
| **Force Diagram** | **Force Diagram** | **Force Diagram** | **Force Diagram** |