Work Sheet 8a - Terminal velocity

Introduction

The force of gravity accelerates skydivers when they jump from an aircraft. However, they do not accelerate at a uniform rate. Air resistance or 'drag' opposes their motion - the faster they fall the greater the drag on their bodies. After a few seconds the skydivers accelerate to a speed at which the air drag is equal and opposite to their weight, they then continue to fall at a steady speed called the terminal velocity.

In this activity you can investigate how the terminal velocity of a sphere falling through air or water depends on its radius and its density.

Preparation

Before you start, review the Introduction and Study Points sections of the topic. In particular make sure you understand what is meant by a drag force and why an object falling through a fluid reaches a terminal velocity.

You will need paper and a pen to record your results.

Getting started

Start by selecting the medium through which the object is falling. You can select air or water by clicking the appropriate buttons towards the top right of the screen.

Next select the radius and the density of the falling sphere.

Click the Release button at the bottom left of the screen to let the sphere fall.

As the sphere falls, a graph of its velocity against time is plotted, and its velocity is displayed.

Recording your results

On a sheet of paper construct a suitable table to record your results. You will need to record the radius and density of each sphere, the medium through which it is falling and the terminal velocity reached.

Things to investigate

1. How does the terminal velocity of a sphere of a given density, falling through a given medium, depend on the radius of the sphere? (You could plot a graph of terminal velocity against radius to answer this question).

2. How does the terminal velocity of a sphere of a given radius, falling through a given medium, depend on the density of the sphere? (You could plot a graph of terminal velocity against density to answer this question).

3. How does the sphere behave when its density is less than that of the medium in which it is released? (density of water = 1 000 kg/m^3, density of air is approximately 1 kg/m^3).