



In Class (Instructor)



In Class (Students)

Begin Here.

Instructor assigns students to groups of 3-4.

 Work in Groups

 Whole Class

 Research

 Upload

 Problem Solving

 Discussion

Bloom's Taxonomy

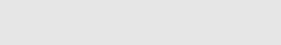
 Remember

 Understand

 Apply

 Analyze

 Evaluate

 Create

The class moves outside to record two videos of falling objects. This is done as a class, however each group will take their own videos. Students should ensure that a distance calibration tool is visible in the video, that the camera is stationary throughout the duration, and that they are far enough back from the objects that the angular geometry does not interfere significantly with their results.

The first object, a soft rubber ball, is dropped from a high place by students or the instructor (for example from the roof or a high window of the school). Students should ensure that at least one member of their group is filming using their phone. This is repeated for the second object, a light object hanging from the handle of an open umbrella.

In the classroom, at computers, students upload the first video into the Tracker Software.

In the tracker software, students use the calibration tool to calibrate their video and set up the axes.

Students use the software to track the position of the object in each frame as a point mass, using the auto-tracking feature or by clicking through frame by frame. The software will automatically generate tabulated position-time data.

Students import the tabulated data into a spreadsheet program such as Excel.

Students use the position-time data to generate data for the velocity of the object. They plot both the position and the velocity, then use the velocity plot to find the acceleration (by taking the slope).

Students repeat the steps for the video of the object tied to an umbrella. In this case they should find that it reaches terminal velocity, and can try to solve for the acceleration both initially and after some time has passed.

Students discuss the differences between the two problems, paying attention to the role that drag forces play. They may also compare the acceleration found for the first object to the acceleration due to gravity.

01

02

03

04