

## PHYSICS 113 – Recitation Assignment 8

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Name

### Recitation Assignment # 8 November 15, 2006

You may complete this in class. However, if you are unable to do so, it is expected that you complete this for recitation next time.

If you have any questions, please ask.

Note that it is expected that you will look at your previous recitation assignments (and the online documentation!) to help you understand the assignment. Please refer to these frequently, and try to *understand* what the code is actually doing.

New Python Concepts: controls (sliders and buttons), labels, functions,

New Physics Concepts: Friction

1. I have put a file called `prog8_starter.py` on the course homepage. Please download it into your recitation directory.
2. There is a note in the incomplete program where you should add the physics. In particular, I want you to add a loop which will shoot a projectile with an initial velocity given by `ball.v`, until the ball has a y-position lower than zero. In particular, I also want you to have an acceleration of:  $-gm/s^2 \hat{j}$  due to gravity (where  $g=9.8$  is pre-set into the program, and can be adjusted). In addition, you want to introduce an air resistance of:

$$F_r = \frac{1}{2} C \rho A v^2$$

where  $C$  is a geometric factor (typically between 0.3 and 1, and,  $\rho$  is the density of the air,  $\sim 1.3 \text{ kg/m}^3$ , and  $A$  is the surface area of your object (say  $0.01 \text{ m}^2$  for something like a baseball). In this case, we have a coefficient of:

$$F_r \simeq 0.003 \frac{\text{kg}}{\text{m}} v^2$$

or a friction deceleration of

$$a_r \simeq 0.003 (\text{meters})^{-1} v^2$$

in the opposite direction of the direction of motion.

Note that in this approximation, the mass of the ball never enters into it at all!

Add in the air resistance term as well. The “mu” in your code should be a normalizing factor such that:

$$a_r \simeq \mu \times 0.003 (\text{meters})^{-1} v^2$$

3. That’s it! That’s all that’s required. **However**, if you’d like to have some fun, you may try some of the following:

- Change the randomization process so that the “target” appears in a random y-position as well as a random distance from the gun.
- Add a scoring procedure to make this a more interesting game.
- Change the target to look like a person – (Use the power of VPython to make a cool object.)
- Add an additional control to give rocket power to the “ball.”