PhyzLab: Ramp Races

an investigation of the linear acceleration of objects rolling down an inclined plane

PLEASE DO NOT WRITE ON THIS SHEET, IT IS A DESK COPY FOR GROUP _____
YOU WILL WRITE YOUR DATA AND ANALYSIS ON YOUR OWN PAPER.
PLEASE LEAVE THIS SHEET FOR NEXT PERIOD TO USE. THANK YOU.

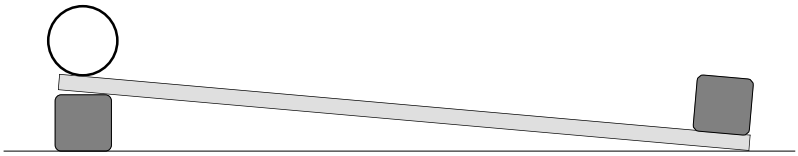
• Question •

Any object that can be picked up can be dropped. We previously found that in the absence of air resistance all objects fall with the same acceleration. A variety of objects can roll down an inclined plane. However, not all objects roll down an incline with the same acceleration. One purpose of this activity is to rank several objects according to the rate at which they roll down the incline. The other is to determine why the ranking comes out as it does.

One clue that can be revealed (to save time and energy): the acceleration of an object rolling down an incline is determined solely by the object's geometry. That is to say that all solid cylinders have the same acceleration down an incline, regardless of their radius, length, or mass. Unusual and unexpected... but who thought all falling bodies would have the same acceleration in a vacuum?

• Apparatus •

___ long board
___ 2 bricks (or equivalent)
___ access to a variety of rolling objects
    ___ hollow cylinder(s)
    ___ solid cylinder(s)
    ___ hollow sphere(s)
    ___ solid sphere(s)
    ___ sloshy cylinder (liquid-filled can) (if available)
___ stopwatch (or equivalent)



• Procedure •

1. Set up the apparatus as shown. If you wish to make a starting line, please use a length of tape and **not** pen or pencil on the incline.

2. CAREFULLY determine the time for one rolling object to roll down the incline. On a separate sheet, record the results of several trials and determine an average. Make a well organized table for the data.

Our apparatus and conditions are less than optimal, so it is important to get several **good** trials and determine an average for each object. If you are running several trials and you get a data point that is very different from the others, throw it out. Get several **good** data points before taking an average. **Please note that several of the rolling objects can be damaged (bent) through careless handling. These objects must be used by lab groups all day, so please handle them with unusual care.**

3. Move on to another rolling object and repeat the previous step until all objects have been timed.

• Analysis •

1. On the basis of your observations, rank—from fastest to slowest—the rate at which the objects roll down the incline.

2. Revisit. Once you think you've got the order down, try a few "head-to-head" races between objects to check your work. You can try to roll them side by side, but there is at least one other way to race two objects that might be more telling. Perhaps you'll come across it in your experimentation. As always, run several trials before coming to a conclusion. Just to be sure, try your slowest object against your fastest first and go on from there. Do you wish to make any changes after running your races?

3. What sources of error are important in this lab? (Is air resistance more important for some of the rollers than it is for others?)

4. Why does the ranking turn out this way? (Hint: consult rotational inertia equations.)