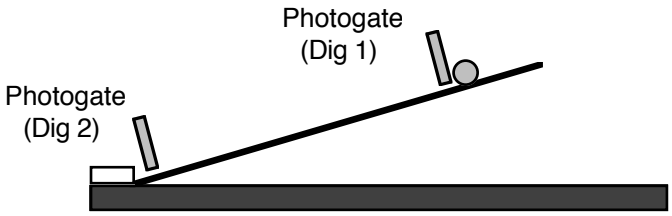
Lab 2-3: **Inclined Plane**

Purpose: 1. To determine a mathematical model for the position as a function of time for a ball bearing rolling down an inclined plane by recording the time it takes the ball bearing to roll from rest a variety of distances down an inclined plane of constant slope.
2. To investigate the effects of gravity on an object.

Materials: 1 large ball bearing, 1 steel track, 2 photogates, 1 meter stick, 3 stands & clamps, 2 C clamps, 1 short piece of wood

Diagram:



Procedure:

1. Using the C clamps, clamp the piece of wood to the end of the lab. Brace one end of the steel track against the wood, and raise the other end up 1 to 3 feet using a stand and a small clamp. The actual slope of the track doesn't matter, as long as it never changes during the experiment.
2. Set up one photogate as close to the bottom of the track as you can so that it will detect when the ball bearing passes by. Connect this photogate to the "Dig/Sonic 2" port on the LabPro. The actual position does not matter, as long as the photogate does not move during the experiment.
3. Set up the other photogate near the top of the ramp and connect it to the "Dig/Sonic 1" port on the LabPro. Try to get at least 1.2 meters between the photogates.
4. Start up Logger Pro by opening *"Mac / Applications / Logger Pro / Experiments / Probes & Sensors / Photogates / Pulse Timer-Two Gates.xmbl."*
5. The goal is to measure the time it takes the ball bearing to roll down a variety of distances, always starting from rest. To start the ball, place it on the track just before it turns on the light in the photogate. Be careful of your fingers getting in the way. Have someone click on "Collect", wait a second for the LabPro to get ready, and then let the ball go. If all goes well, Logger Pro will report how many seconds elapsed between the two photogate flashes. (It will be the number in blue in the right column labeled "Time from Gate 1 to Gate 2." Do this a total of three times, recording the data in the data table.
6. To measure the distance between the photogates, find where the ball bearing just turns on the light of each photogate, and measure that distance.
7. After you have 3 trials for this distance, move the upper photogate down the ramp about 10 cm, and repeat above. Keep doing this until the photogates are 5 cm apart.

Data:

Distance Traveled (cm)	Times (s)		

Distance Traveled (cm)	Times (s)		

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Graphs:

1. Make a graph that shows Distance vs. time. **Don't average your times**, just plug all the data into Graphical Analysis. **Don't add any columns**, just type in each distance three times – once for each recorded time interval. This graph will not be a straight line, so just make sure everything is labeled correctly, but don't do any best fit lines.
2. Linearize the graph to find the mathematical equation that relates distance and time for your ball bearing rolling down a hill.

Conclusions:

1. What is the equation that relates distance and time for your ball bearing rolling down the track?

2. Based on your answer to question 1, what is the equation that relates velocity and time for your ball bearing rolling down the track?

3. Based on your answer to question 2, what is the equation that relates acceleration and time for your ball bearing?

4. If you made the track steeper and steeper, and kept repeating the experiment, what would happen to your results? (Qualitatively.)

5. Make a general statement about the acceleration of a ball bearing down a track.

6. Imagine you keep doing the experiment until the track is perpendicular to the lab table. What can you probably conclude about gravity?