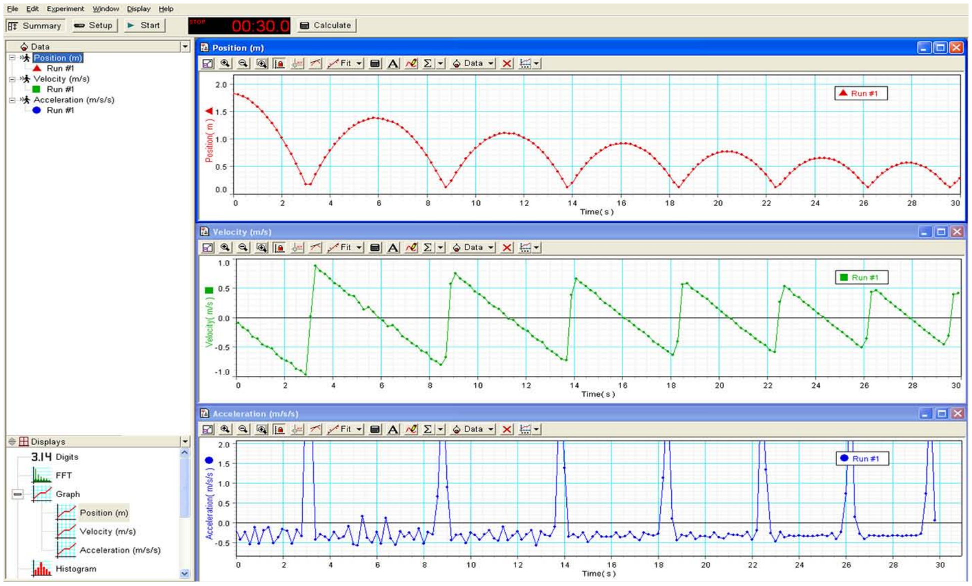
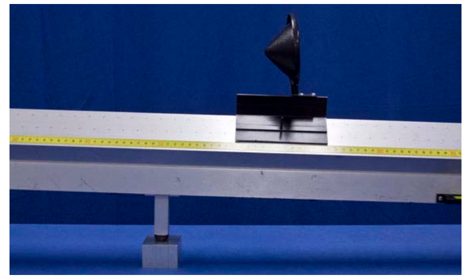
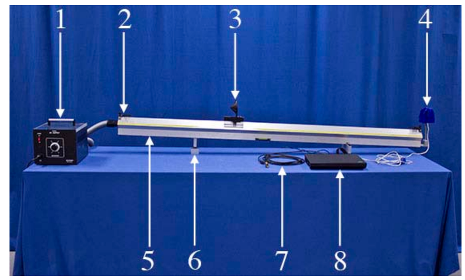
INCLINED AIR TRACK 1C20.35

Mechanics | Motion in One Dimension | Uniform Acceleration







Concept:

Challenge your students to sketch graphs of $x(t)$, $v(t)$ and $a(t)$ for a bouncing ball. Then, show them the real time graphs for the qualitatively similar case of a glider bouncing on an inclined track.

Some talking points:

- *Between* bounces, the acceleration reads – 0.3 m/s^2 (the noise about this value smoothes out with time). This value of acceleration can be confirmed by examining the slope of the corresponding $v(t)$ graph. Acceleration between the bounces can also be checked using $g\sin(\theta) = -9.8\ \text{m/s}^2\left(\frac{3.4\ \text{cm}}{100\ \text{cm}}\right) = -0.3\ \text{m/s}^2$. Here the height of the block is 3.4 cm and the length of the support base is 100 cm.

- *During* a bounce, the peak acceleration can be determined from the slope of the $v(t)$ graph. For the first bounce this gives $\frac{1.9\ \text{m/s}}{0.3\ \text{s}} = 6\ \text{m/s}^2$ and thus is on order of one "g".

- Friction between the glider and track, thermal dissipation in the rubber bumper, and air resistance, all act to reduce the bounce amplitude.

Equipment:

1. Air Supply
2. (2) Bumpers
3. Glider with Sonic Reflector
4. Pasco Motion Sensor
5. Air Track
6. Aluminum Block (3.4 cm)
7. VGA Extension Cable
8. Laptop with Pasco DataStudio

Procedure:

1. Verify that the Pasco Motion Sensor is connected to the laptop and that the DataStudio software suite is open to the "Inclined Air Track" activity. Turn on the air supply.
2. Press the "Start" button on the screen to start the 5-second countdown to data collection. (If the "Start" button is grayed out, unplug the motion sensor's USB cable and plug it back into the computer.)
3. Quickly position the glider near the top of the air track incline and release it at about the same time that data collection begins.
4. Notice that the glider's position, velocity and acceleration are plotted in real-time for 30 seconds.
5. To erase all collected data and repeat the demonstration, click on the "Experiment" menu and select "Delete All Data Runs."