Changing Force

Software

- VPython, Python and the graphical user interface (GUI) IDLE (or VIDLE)

> Models are only as valid as the physics used to create them.

Objective

Gain experience writing VPython programs

- Create and use graphics windows to plot variables

Learn how to animate an object with non-constant force

Learn how to effectively search for help in tutorials and reference manuals

Group

Model a cart (the green lab cart) on a track (2 meters long).

- Start your cart on an end with no initial velocity.
- Determine the average force needed to make your cart travel the length of the track in 10 seconds. Your force can only be applied for ½ second.
- Create graphic windows to plot the cart's position, velocity and force as a function of time.
- Widen the track so you can add a second cart that is twice as massive. Race the carts. You can also just stack carts above one another – whatever makes it easiest for you to visualize.

NOTE: Use your code from last week as a starting point. Make sure to keep your old programs.

Individual

This week you will model carts with different masses on a track being acted on by a non-constant force.

Expand the track you created in your group activity to accommodate three carts. You can also just stack carts above one another – whatever makes it easiest for you to visualize. Make the third cart one half the mass of the original cart. You will need to create two different models to answer the following questions.

1. Apply the same constant force on each cart for 1 second to make them move down the track. Make sure that the force you choose does not send any of the carts off the track. When there is no longer any net force on the carts:
   a. Determine which cart is traveling fastest.
   b. Determine which cart has the greatest momentum.
2. Assume your track is at a 10 degree angle. Apply the appropriate gravitational force to each cart. When each cart reaches the end of the track:
   a. Determine which cart is traveling fastest.
   b. Determine which cart has the greatest momentum.

Note : An easy way to show what you determine is by using graphs.

Advanced

Create a program of your own choosing to model a physical event.

- Model an object thrown into the air
- Model a mass on a spring
- Model a gravitational interaction – for instance an object in "orbit"

NOTE: You only need to complete one A-level lab exploration – either a computer model or an analog lab investigation.