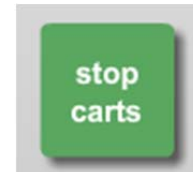
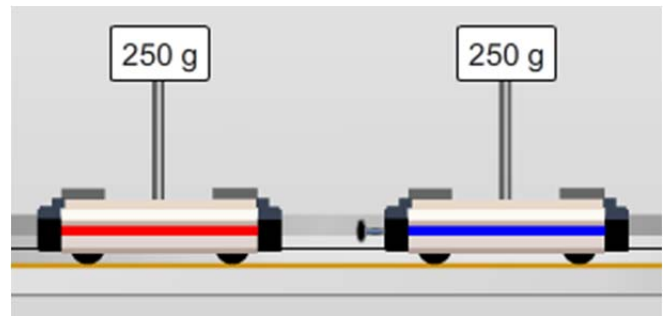


## 5 – Momentum User's Guide:

06/10/2014

**The carts.** On the track there are two carts, one red and one blue. Their mass is 250 g, and that base mass plus any additional mass added is shown in the flag.

The carts can be moved along the track by clicking and dragging. Release the cart by letting off of the mouse button. If the mouse is moving when the cart is released (unclicked) the cart will be flung at the speed of the mouse movement. If it is stationary it will remain so. If the cart that is not being clicked on is moving, it will be paused until the active cart is released. To stop both carts at the same time, click the "Stop Carts" button under the track.



**The launchers.** Located at either end of the track, the orange launchers can be used to shoot the carts towards the middle of the screen. If a cart is placed next to a launcher, it becomes attached. From this position, the launcher can be pulled back by clicking and dragging the white knob on the side of the housing. The farther this knob is pulled back, the more the spring is compressed, and the farther the cart will go upon release.

To release the spring, click on the appropriate button below the track, either "Release Left", "Release Right", or "Release Both." Whether the launchers are engaged or not, a cart thrown towards a launcher will bounce off of it and reverse directions.

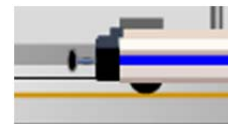


release  
left

release  
both

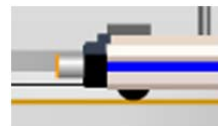
release  
right

**The spring plunger.** By default, the carts will bounce off of each other like they bounce off of the launchers. This is due to a spring plunger on the left side of the blue cart. When this is selected under the "Cart Accessory" options, the plunger remains on the blue cart and the two carts will bounce off of each other. This will be used for elastic collision cases.



Spring Plunger

**The Velcro.** To explore inelastic collisions, the spring plunger can be replaced with Velcro by selecting the “Velcro” option in the accessories. When this is turned on, the carts will stick together whenever they hit. To separate, just click and drag either cart away.



Velcro

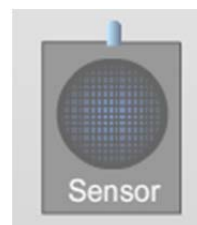
**Disc Masses.** In the bottom left corner of the screen there are 5 disc masses. Each brass disc has a different mass, and from left to right those masses are 10g, 20g, 50g, 100g, and 200g. To add mass to a cart, click and drag any of the masses to the post on center of the cart and release. As much as 750g can be added to each cart in addition to the cart’s inherent 250g mass.



remove masses

To remove the masses, either double-click on a cart to remove the top most mass, or click on the “Remove Masses” button to remove all masses from both carts.

**The motion sensor.** To the left of the track there is a grey motion sensor that is used to monitor both carts. By default the detector is inactivated. To turn it on or off, just click it. Once on, the sensor will turn towards the track and data collection will begin. *The data in the table and in the graph is erased each time the sensor is turned back on.*

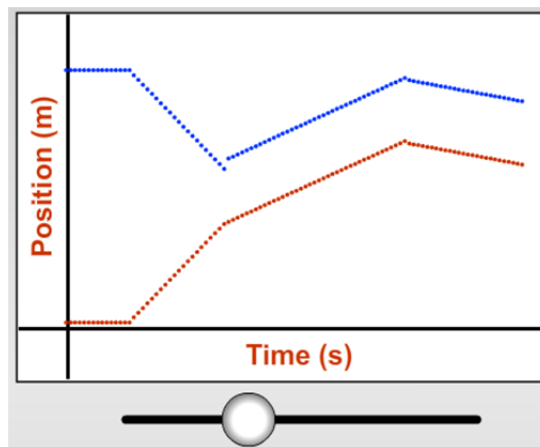


**Numerical Data.** When the motion sensor is on, the positions of the two carts are recorded over time. In the white box in the upper left corner, three columns are shown that display this information. The first column is for time (seconds), the next column is the position of the red cart (meters), and the third column is the position of the blue cart (meters). The latest data will be displayed once the sensor is turned off and the data is not actively being collected. To clear all data, just start the sensor again. To copy the data to be pasted in a separate program like Grapher, just click the “Copy to Clipboard” button below the data table.

Time	RedCartPosition	BlueCartPosition
(s)	(m)	(m)
0	0.587	1.309
0.032	0.587	1.309
0.065	0.587	1.309

**Copy to Clipboard**

**Graphical Data.** The graph in the top right corner can be used to visualize the positions of the two carts versus time. Each time the motion sensor is turned on, this graph resets and begins showing a live representation of the red and blue carts. The scale of the x-axis (time) can be adjusted by clicking and dragging the white knob on the slider below the graph. If the graph is full and no longer updating, reset it by turning the motion sensor off and then back on again.



**Sketch.** Many of our labs have a Sketch option that allows the user to draw various things on the screen that may be helpful during the experiment. In this case, pressing the Sketch button brings up a graph and several drawing tools. Click and drag on any of these buttons (point, line, curve, vector, label) to add them to the screen. Clear Sketch will clear all of these elements. Hide Axes will simply hide the axes on the sketch graph if you just want a blank canvas to work with.

**Sketch**

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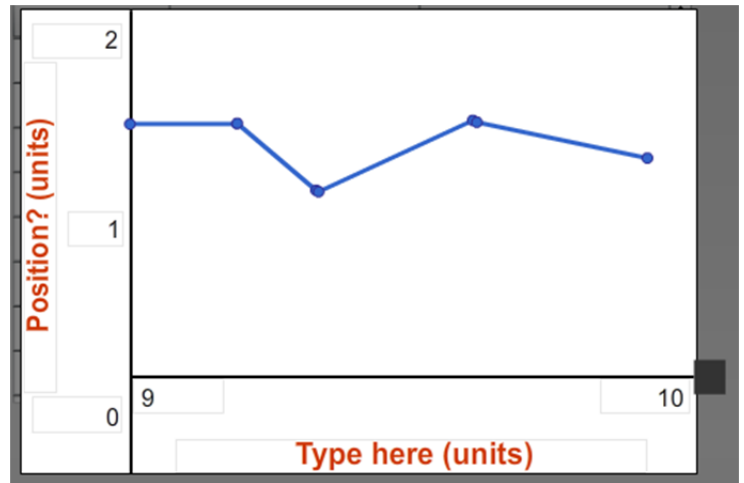
Hide Axes

↗

Aa

Clear Sketch

**Sketch Graph.** The graph that comes up with the Sketch option is customizable. The axis labels can be changed by clicking in the text boxes and typing whatever you need. The Numerical values on the x and y axis can also be changed. The position of the x axis can be moved up or down by clicking and dragging on the dark grey handle to the right.



**Snapshot.** As with most of our labs, you can take a screenshot of any portion of the screen by clicking on the Snapshot icon and then clicking and dragging a box around what you want to capture. A dialog will then appear asking you what you want to call the image and where you want to save it. In most labs, a timestamp will be added to the image to keep track of it better.

