**Collisions & Explosions with Vernier SensorCart**

(Assumes the use of Bluetooth connection to device with Graphical Analysis 4 app.)

1. Basic idea of lab:

* Use the built-in spring plunger to allow two SensorCarts to have collisions or explosions.
* Take rubber anti-roll peg out of the carts if using on a lab table.
* Set up monitoring of Velocity of the cart (Found by setting up Position.)
* Study effects on Kinetic Energy and Momentum.
* Change masses to verify the rules.

Cart w/ Plunger

Cart w/ Plunger

1. Turn the Sensor Carts ON by pressing their power buttons. A blinking red LED will indicate that it is working.
2. Launch Graphical Analysis 4 on your device or computer. When it comes up, it will display a menu from which you will choose “Sensor Data Collection”.
3. Connect to both of your SensorCart, choosing them by matching the serial number. (Hint: The last four numbers or letters should be sufficient for this.)
4. Under **SENSOR CHANNELS** choose **Position**. Note that you can get position, velocity and acceleration when you monitor “Position”.
5. Set up two graphs, one for **Velocity vs Time** for one of the carts and the other for **Velocity vs Time** for the other cart.
6. Press the spring plunger in until it clicks into position. Put the SensorCart in the starting position. Click/Tap on the **Position** field and **Zero** that reading for both carts.
7. Click on the **Mode** field. Set up data collection to50 samples/s.
8. Click/Tap on “**Collect**” to begin data collection. Tap the trigger with a meter stick to cause the plunger to push outward.
9. Double-click or double-tap on both graphs to autoscale them. Determine the velocity of each cart before and then after the explosion. Record in the Data Table.
10. Calculate the respective Kinetic Energies and Momentums.
11. Change the setup by adding or subtracting masses from the carts. Repeat steps 7 to 11 for the new combination.
12. Change to a collision mode, using the spring plunger to impact either a stationary cart of one that’s moving before the collision. Repeat steps 7 to 11.

**DATA COLLECTED**

Mass of Cart #1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Mass of Cart #2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

|  |  |  |  |
| --- | --- | --- | --- |
|  | **Trial 1** | **Trial 2** | **Trial 3** |
| Initial velocity of Cart 1 |  |  |  |
| Final velocity of Cart 1 |  |  |  |
| Initial velocity of Cart 2 |  |  |  |
| Final velocity of Cart 2 |  |  |  |
| Initial momentum of Cart 1 |  |  |  |
| Final momentum of Cart 1 |  |  |  |
| Change in momentum 1 |  |  |  |
| Initial momentum of Cart 2 |  |  |  |
| Final momentum of Cart 2 |  |  |  |
| Change in momentum 2 |  |  |  |
| Change in Kinetic Energy 1 |  |  |  |
| Change in Kinetic Energy 2 |  |  |  |

This is the beginning of a longer lab exploration. Hopefully you will see how easily it can be done and give your students the opportunity to do this on their own. Also they can explore other types of collisions as well as making the spring plunger tighter or looser. Lots of good lab time here.

*C. Bakken – 4/2019*