**The Conservation of Momentum and Collisions** Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Data**

Go to **www.gigaphysics.com**, then go to Virtual Labs, and then click Conservation of Momentum. (<http://www.gigaphysics.com/momentum_lab.html>)

Click New Experiment.

**Part I: Measure the Carts**

* Find the length of the purple cart, use your mouse to drag the cart over the caliper in the upper left corner of the lab.
* Find the masses of the carts by dragging each one in turn over the electronic balance in the upper right corner.



**Part II: Inelastic Collisions**

* Select “same direction” from the Carts’ Direction menu and “inelastic” from the Collision Behavior menu.
* Click “Start Carts” to put the carts in motion. The red numbers you will soon see tell you how many seconds it took each cart to pass through that photogate. If you lose track of which photogate is measuring which cart, notice the purple and green arrows labelling each; a half purple/half green arrow is used when both carts were stuck together as they passed through. You can also click **Start Carts** if you want to watch the collision again.
* Record your times in the data table. Also copy the lengths from part I. ***Be sure to add the lengths of the two carts when the carts are stuck together.***
* Calculate each cart’s velocity and enter it in the table as well.



* Use the fact that **momentum = mass**$ • $**velocity** to calculate the momentum of each cart. Remember to add the masses when the carts are stuck together.



* Calculate the total momentum of the two carts before and after the collision.



  **Part III: The Elastic Collision**

* This time, set the **Carts’ Direction** to opposite and the **Collision Behavior** to elastic. Repeat the same steps as in part II. Remember, your ***lengths*** are the ***same from part I.***
* When you calculate the velocities and momentum, ***signs*** matter. Make sure that carts that are moving to the left have negative velocities. If you lose track of which direction the carts were going for each photogate, you have the arrows to help you, and you can click **Start Carts** to watch the collision again.







**Part IV: One More Case**

* Repeat the experiment once more, this time with any combination of Carts’ Direction and **Collision Behavior** you have not used already. Record which settings you use, then complete the calculations as before.





***The Conservation of Momentum and Collisions***

Name:

**Analysis and Conclusion**

Complete the table below for each collision. You will be drawing a diagram of the three collisions you studied. This diagram can be just boxes and arrows. Make sure to include the data that is requested as well.

***Collision 1***

|  |  |  |
| --- | --- | --- |
| **Mass** | **Before Collision** | **After Collision** |
| Green |  | Green  |  |
| Purple |  | Purple |  |
| **Velocity** | Green |  | Green  |  |
| Purple |  | Purple |  |
| **Momentum** | Green |  | Green |  |
| Purple |  | Purple |  |
| TOTAL |  | TOTAL |  |
| **Diagram** | *Before Collision* | *After Collision* |
|  |  |  |

1. Explain what happened to the masses of the two cars before and after the collision.
2. Explain what happened to the velocity of the two cars before and after the collision.
3. Explain what happened to the momentum of the two cars before and after the collision.
4. What did you observe about the total momentum before and after the collision?

***Collision 2***

|  |  |  |
| --- | --- | --- |
| **Mass** | **Before Collision** | **After Collision** |
| Green |  | Green  |  |
| Purple |  | Purple |  |
| **Velocity** | Green |  | Green  |  |
| Purple |  | Purple |  |
| **Momentum** | Green |  | Green |  |
| Purple |  | Purple |  |
| TOTAL |  | TOTAL |  |
| **Diagram** | *Before Collision* | *After Collision* |
|  |  |  |

1. Explain what happened to the masses of the two cars before and after the collision.
2. Explain what happened to the velocity of the two cars before and after the collision.
3. Explain what happened to the momentum of the two cars before and after the collision.
4. What did you observe about the total momentum before and after the collision?

***Collision 3***

|  |  |  |
| --- | --- | --- |
| **Mass** | **Before Collision** | **After Collision** |
| Green |  | Green  |  |
| Purple |  | Purple |  |
| **Velocity** | Green |  | Green  |  |
| Purple |  | Purple |  |
| **Momentum** | Green |  | Green |  |
| Purple |  | Purple |  |
| TOTAL |  | TOTAL |  |
| **Diagram** | *Before Collision* | *After Collision* |
|  |  |  |

1. Explain what happened to the masses of the two cars before and after the collision.
2. Explain what happened to the velocity of the two cars before and after the collision.
3. Explain what happened to the momentum of the two cars before and after the collision.
4. What did you observe about the total momentum before and after the collision?