Name _____ Date _____ Period _____

Elastic and Inelastic Collisions

Find the Lab

- In your web browser, go to **www.gigaphysics.com**, then go to **Virtual Labs**, and then click **Conservation of Momentum**.
- If someone else used the computer for this lab before you, click **New Experiment**. This will ensure that you have your own unique cart data when you do the experiment.

Part I: Measure the Carts

- To 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. Convert the length to the SI unit of meters, then record it in the table below. Repeat the procedure for the green cart.
- Find the masses of the carts by dragging each one in turn over the electronic balance in the upper right corner. The balance reads in grams, so convert each mass to the SI unit of kilograms, then record your data.

Mass of purple cart	Length of purple cart	Mass of green cart	Length of green cart

- *These measurements will stay the same as long as you don't refresh the screen or click the button to start a new experiment. If you don't complete the lab if one sitting and have to load the lab page again, the lengths and masses will change. If this happens, you will need to measure them again and use the new values for the remainder of the lab.*

Part II: Determine the Carts' Velocities (Inelastic Case)

- 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 at the top of the next page. 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.

	Elapsed time	Length	Velocity
Purple cart before collision			
Green cart before collision			
Carts stuck together after collision			

Part III: Calculating Momentum and Kinetic Energy

- Calculate the momentum and kinetic energy for each cart, using the masses from part I and the velocities from part II. Remember to add the carts' masses when the carts are stuck together.

	Mass	Velocity	Momentum	Kinetic energy
Purple cart before collision				
Green cart before collision				
Carts stuck together after collision				

- Now add the results for the purple and green carts to determine the total momentum and kinetic energy before the collision. Your total after the collision is the same as you just calculated for the carts when they were stuck together, since there is nothing else to add.

	Total momentum	Total kinetic energy
Before collision		
After collision		

Part IV: Compare the Elastic Case

- Change the **Collision Behavior** to elastic and repeat the steps from parts II and III.

	Elapsed time	Length	Velocity
Purple cart before collision			
Green cart before collision			
Purple cart after collision			
Green cart after collision			

	Mass	Velocity	Momentum	Kinetic energy
Purple cart before collision				
Green cart before collision				
Purple cart after collision				
Green cart after collision				

	Total momentum	Total kinetic energy
Before collision		
After collision		

Part V: The Partially Elastic Case

- Repeat the experiment once more, this time with **Collision Behavior** set to partially elastic.

	Elapsed time	Length	Velocity
Purple cart before collision			
Green cart before collision			
Purple cart after collision			
Green cart after collision			

	Mass	Velocity	Momentum	Kinetic energy
Purple cart before collision				
Green cart before collision				
Purple cart after collision				
Green cart after collision				

	Total momentum	Total kinetic energy
Before collision		
After collision		

Part VI: Draw Conclusions

Remember that when physicists say that something is conserved, they mean that it can never be created or destroyed. In other words, if something is conserved, then there is the same amount at the end of a process as there was at the beginning.

Using this definition and your calculations from the lab, fill in the chart below.

	Is momentum conserved?	Is kinetic energy conserved?
Inelastic collision		
Elastic collision		

Summarize your conclusions by filling in the blanks in the sentence below.

_____ is conserved in all kinds of collisions, whether elastic or inelastic, but _____ is conserved only in elastic collisions.

Based on your results from part V, should a partially elastic collision be considered to be elastic or inelastic for purposes of predicting which quantities will be conserved?

Suppose that you wanted to use either conservation of momentum or conservation of kinetic energy to predict the outcome when a large car collides with a smaller car in a demolition derby. Which of the two quantities would be more appropriate for your calculation? Explain.