

Elastic vs. Inelastic Collisions

Part I: Introduction

In this simulation you will investigate the difference between elastic and inelastic collisions. To begin, go to www.gigaphysics.com in your web browser, then to the **Conservation of Momentum** lab. If you are using a computer that another student has just used for this lab, be sure to click the **New Experiment** button to get your own individual data.

Part II: Measure the Carts

You will need the length and mass of each cart to perform the calculations for the rest of the lab. To find the mass of each car, click the **Green Car to Balance** and **Purple Car to Balance** buttons and read the value displayed on the balance. Convert the masses to SI units, and record these masses in the table below.

mass of green cart		mass of purple cart	
length of green cart		length of purple cart	

Similarly, find the length of each cart by using the **Green Car to Calipers** and **Purple Car to Calipers** buttons. Convert the displayed values to SI units and record those values in the table as well.

Part III: Inelastic Collision

Set the **Carts' Direction** to **Same direction** and the **Collision Type** to **Inelastic**. Then click the **Start Carts** button and watch what happens. You will see the carts pass through the various photogates, and when they do, each photogate displays the time it takes the cart to pass completely through that photogate. Notice the purple and green arrows to help you keep track of which cart (and in some cases which direction of travel) was being measured. An arrow that is half green and half purple means that the carts are stuck together as they pass that point. If you want, you may click the **Start Carts** button a couple of times to get used to what the simulation is showing you. Use the **Reset Carts** button to reset the carts to their starting position between trials.

When you're ready, click **Start Carts** one last time and record the photogate data in the chart below. Also add the length data from part II into the chart to help organize your work. For the case in which the carts are stuck together, be sure to add the carts' lengths.

Now that you know both how long the carts are, and how long it took that length to pass through each photogate, you can calculate the carts' velocities and add them to the table as well.

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

Part IV: Momentum and Kinetic Energy

Using the masses from part II and the velocity from part III, calculate the momentum and kinetic energy for each cart and enter your results in the table below. Remember to use the total mass of the two carts when the two are stuck together.

	Mass	Velocity	Momentum	Kinetic Energy
Green cart before collision				
Purple cart before collision				
Carts (stuck) after collision				

Now add the results for each cart to find the total momenta and kinetic energies of the two carts before and after the collision.

	Total momentum	Total kinetic energy
Before collision		
After collision		

You and your instructor may wish to review your results at this point, so that you can correct any errors before repeating them in the next set of calculations.

Part V: Elastic Collision

Change the **Collision Type** to **Elastic**. Repeat the procedure from parts III and IV, except that this time the carts will not stick together.

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

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

	Total momentum	Total kinetic energy
Before collision		
After collision		

Part VI: Partially Elastic Collision

This time, change the **Collision Type** to **Partially Elastic** and repeat once more.

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

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

	Total momentum	Total kinetic energy
Before collision		
After collision		

Part VII: 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 the amount of the quantity at the beginning of a process and the end of the process must be the same. Using this definition and your calculations from this lab, fill in each cell of the chart below.

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

Summarize your conclusions by filling in the blanks below.

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

Based on your results in part VI, does a partially elastic collision act like an elastic collision or an inelastic collision with respect to this basic principle? Explain.

Suppose that you wanted to predict the outcome of two cars colliding in a demolition derby. Would it be more appropriate to use conservation of momentum or conservation of kinetic energy for your calculation? Explain.

