The Cart and the Brick Interactive

Background:

In this Interactive, you will analyze a collision in order to determine the total momentum of a system before and after the collision. Your goal is to gather evidence that supports the law of conservation of momentum. The collision involves the collision between a stationary brick that is *dropped upon* a moving cart. The brick lands upon the cart and travels at the same speed as the cart after the collision. A ticker tape is attached to the cart and pulled along with the cart through a ticker tape timer. Ticks (dots) are placed upon the tape every 1/60-th of a second, leaving a trace of the cart's position over the course of time. Analysis of the ticker tape allows one to determine the velocity of the cart before and after the collision. The Interactive offers a short tutorial on the analysis of the ticker tape. The tutorial is highly recommended to those unfamiliar with ticker tape analysis; it can be accessed from the first screen of the widget.

Purpose:

To analyze a collision in order to accumulate evidence that supports the law of conservation of momentum.

Discussion of Procedure:

There are 18 collisions to analyze. Each collision differs in terms of the mass of the cart, the mass of the brick, and the pre-collision speed of the cart. It is not necessary to analyze all 18 trials. Select two or three trials to analyze or analyze those collisions that were assigned to you by an instructor (if completing the activity as a class assignment).

Select the trial from one of the two **Experimental Conditions** screens. Observe the animation; repeat it if necessary. Then tap the **Analyze Data** button. The ticker tape is displayed with a centimeter-ruler positioned below it. The collision point is indicated. Measure the distance associated with 6 spaces (or 12 spaces) between dots on the pre-collision side of the tape. Record the distance and the time on the pre-collision side of the data table. The time is 0.10 seconds for 6 spaces and 0.20 seconds for 12 spaces. Repeat the procedure for the post-collision side of the tape and record. Velocities can be calculated for the cart (before collision) and for the cart and the brick (after the collision) as the distance/time ratio. The mass of the cart and of the brick (shown on the screen) can be used to determine the momentum of each object. The momentum of the individual objects can be *summed* to determine the system momentum. Because the distance values are the results of measurements, small amounts of error are inherent in the process of determining the momentum of the objects.

Data tables are provided for two trials. Additional tables can be made if necessary.

Data

Trial: _____

		Before Collision				After Collision			
	Mass (kg)	Distance (cm)	Time (s)	v (cm/s)	p (kg•cm/s)	Distance (cm)	Time (s)	v (cm/s)	p (kg•cm/s)
Cart									
Brick									
System									

Trial: _____

		Before Collision				After Collision			
	Mass (kg)	Distance (cm)	Time (s)	v (cm/s)	p (kg•cm/s)	Distance (cm)	Time (s)	v (cm/s)	p (kg•cm/s)
Cart									
Brick									
System									

Conclusion

Does the collision between the cart and the brick follow the law of momentum conservation? Make a claim (yes or no) and support the claim by describing the evidence and reasoning that that supports it. Use a separate page if necessary.