Module 5: Impulse and Momentum
Topic 4 Application: Conservation of Momentum in Collisions

Before you begin the scientific investigation below, make sure to download the One Dimension Collisions Scientific Investigation Report. As you complete this scientific investigation, fill in any needed information on the report template. If you need more information about each section of the report, please visit the Developmental Module.

Introduction

Interactions other than explosions are generally categorized as collisions. Elasticity is a measure of the amount of kinetic energy that is conserved after the collision. Normally, when objects bounce off of each other some kinetic energy is lost. In special cases, the kinetic energy is conserved. When they bounce, they are usually somewhat inelastic, and in special cases, they are perfectly elastic.

Objectives

In this scientific investigation, you will:

- graphically display vectors before and after each collision trial.
- explain "elasticity."
- identify which variables are conserved and under which conditions.
- identify vector and scalar quantities.

Hypothesis

Using the **Procedure and Data Collection** section below, read through the procedural information for this scientific investigation. Based on your understanding of the procedure, develop your own hypothesis which describes your expected results. What is the relationship between mass, velocity, and momentum? Record these hypotheses in the **Hypothesis** section of your One Dimension Collisions Report.

Required Simulation

Collisions PhET Simulation

Provided by:
PhET Interactive Simulations
University of Colorado
http://phet.colorado.edu

Procedure and Data Collection

Simulation Set-Up

1. Open the Collision Lab simulation.
2. Select the "Introduction" tab.
3. On the right side of the simulation window, select Velocity Vectors, Kinetic Energy, and Show Values.
4. Toward the bottom left of the screen, select "More Data."

Mass, Velocity and Collision

1. Record the pre simulation data on the One Dimension Collisions Scientific Investigation Report
2. Click the "Play" button to begin the simulation. Observe the collision and then click "Pause."
3. Record the post simulation data on the One Dimension Collisions Scientific Investigation Report.
4. Draw a picture representing the vectors before and after the simulation.
5. Click the "Reset" button.
6. Repeat steps 1-5 three more times, changing the mass of Ball 1 or Ball 2 prior to step 1 on each simulation.
7. Repeat steps 1-5 four more times, changing the velocity of Ball 1 or Ball 2 prior to step 1 on each simulation.
8. Using the simulation, run several simulations changing the velocity of Ball 1 and/or Ball 2 each time. Note the simulation data in the One Dimension Collisions Scientific Investigation Report.

Data

In the **Data Analysis** section of your One Dimension Collisions Scientific Investigation Report, provide responses to the following questions:

Effect of Mass In One Dimension Collision

1. Did you increase the mass of Ball 1? If so, what effect did increasing the mass of Ball 1 have?
2. Did you decrease the mass of Ball 1? If so, what effect did decreasing the mass of Ball 1 have?
3. Did you increase the mass of Ball 2? If so, what effect did increasing the mass of Ball 2 have?
4. Did you decrease the mass of Ball 2? If so, what effect did decreasing the mass of Ball 2 have?

Effect of Velocity In One Dimension Collision

1. Did you increase the velocity of Ball 1? If so, what effect did increasing the velocity of Ball 1 have?
2. Did you decrease the velocity of Ball 1? If so, what effect did decreasing the velocity of Ball 1 have?
3. Did you increase the velocity of Ball 2? If so, what effect did increasing the velocity of Ball 2 have?

Conclusion

Using the **Conclusion** section of your One Dimension Collisions Scientific Investigation Report, compose three to four sentences describing an overall conclusion about one dimension collision based on your data. Were your hypotheses true or false, and how do you know? Use the data and notes that you collected from your simulation experience to form your conclusion. Make sure that you include information that you gained from data analysis to support your conclusion.

Experimental Sources of Error

On your One Dimension Collisions Scientific Investigation Report, provide responses to the following questions: **Are there any sources of error? If so, what are they and what could be done to minimize error?**

Once you have completed the One Dimension Collisions Scientific Investigation Report, please submit your work to the dropbox.