George Mason University

Lab 7: Conservation of Linear Momentum

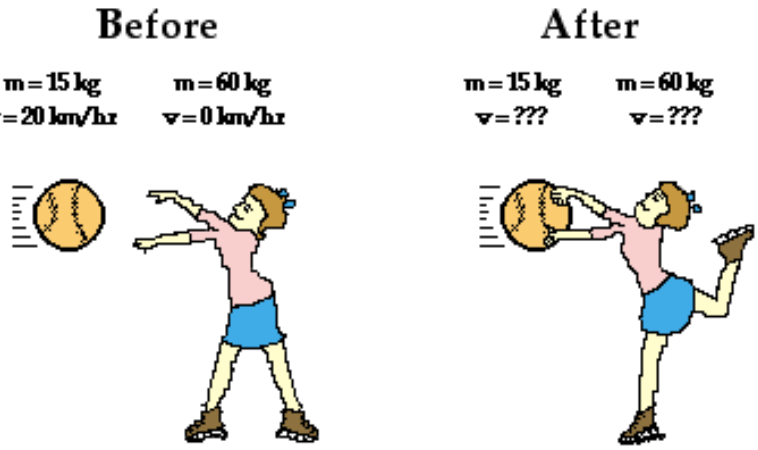

Figure 1: Ice Skater and the basketball - see problem at http://www.physicsclassroom.com/class/momentum/Lesson-2/Using-Equations-as-a-Recipe-for-Algebraic-Problem

Discovery Lab and Presentation

2-wk. Assignment

Student groups will be assigned a "GOAL" and present results to the class the following class meeting using PowerPoint or other presentation software.

Introduction

In this lab, your group will be assigned a collision type and a conservation law to examine. Your instructor will assign your group task when you come to the lab. Last week you examined Conservation of Energy and this week you will add another important Conservation Law to solve problems with – Conservation of Linear Momentum. This law is applicable whenever two objects collide that are moving in a linear fashion (meaning not rotating).

Your group will devise a well thought out procedure that addresses both accuracy and precision. This means that doing the procedure one time will not be appropriate as you have seen in previous labs that multiple measurements allow for a precision measurement.

The equipment you will use will be the same dynamic track, some additional dynamic carts especially designed for collisions, and the motion sensor and Capstone software. Remember that in all previous labs data collection was set at 40Hz, you may need to raise this value – make sure when considering your procedure you consider data acquisition rates.

To examine collisions you will have 2 motion sensors facing in opposite directions to record the motion of the two carts that will collide. Because of this – the motion recorded on the sensors will define the + motion in the opposite direction. To remedy this confusion with the + direction – when connecting one of the motion sensors – choose properties and check the box **'change sign'** so that BOTH of the sensors have the same + direction. **Only check this box for ONE sensor** so BOTH sensors have the same direction of + motion.

There are several experiments that will be conducted today. A listing of some possible experiments is shown below:

1. Conservation of Momentum for an elastic collision. One cart initial velocity. (Carts with repelling magnetic end so carts repel each other.)
2. Conservation of Energy for an elastic collision.
3. Conservation of Momentum for an inelastic collision. (Carts with 'attractive' magnetic ends to they 'stick together' after impact.)
4. Conservation of Energy for an inelastic collision.
5. Conservation of Momentum for both carts initially motionless. (Spring loaded cart sets into motion). Here also students can think about Newton's 3rd Law.
6. Conservation of Energy for spring loaded cart.

Students may create experiment as they see fit but **should try to explore as much as possible.** For Example:

1. How does mass change results if at all?

2. If carts are different masses – how does this impact results?

Students should run through their experimental procedure with the instructor and the values found when completed experimentation before leaving class. It is the group's responsibility to have the theoretical physics correct for analysis of their data. Students who present model that doesn't match theory will have points deducted from presentation.

Materials available to use for data collection and analysis:

Dynamics track, Capstone, Motion Sensor, Excel

#1 and 2: two dynamics carts with magnet ends
#3 and 4: two dynamics carts with Velcro ends
#4 and 5: one dynamics cart with spring-loaded plunger

Reference

Giancoli, Physics 6th Edition: Chapter 7,
sections: 1,2,4,5,6