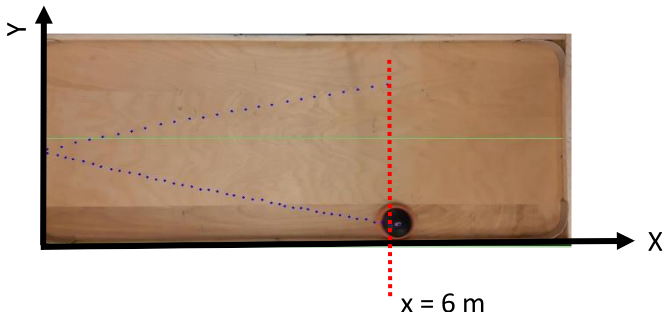
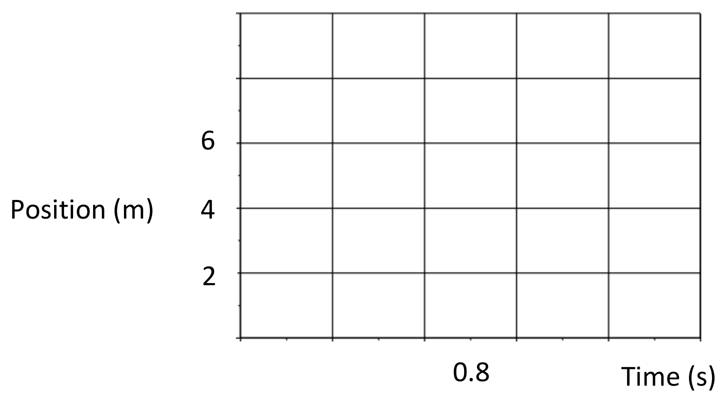
Air Hockey Demonstration: Worksheet

1. Suppose an m = 18.8g air hockey puck is given an initial velocity of 7.8 m/s in the negative x direction and a velocity of 1.5m/s in the negative y direction as shown in the diagram below, the puck starts at a distance 6m from the end of the rink. When the puck reaches the end of the rink a force is exerted by the wall of the rink on the puck which causes it to change direction and return to its initial x position.



   a. Predict the shape of the plot of x position as a function of time



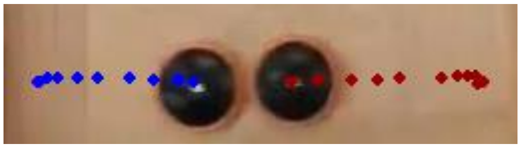
   b. What does the slope of this curve represent?

   c. If we assume the slope of the curve is constant (ignore losses due to friction) from when the puck is released (x = 6m) until right before it collides with the end wall (x =0) what is the momentum of the puck during this time interval? What is the kinetic energy?

   d. When the puck finally reaches the end wall a collision occurs. This is an example of an elastic collision / inelastic collision (circle one).

   e. In the data we collect from real world systems we must consider the effects of friction on energy loss. How will friction affect the slope of the curve, and the velocity of the puck over time?

2. Now suppose we have 2 pucks each identical to the one described in the previous problem. They are each released with a velocity of 7.8 m/s towards one another. The path of the pucks is shown below:



   a. Assume the collision between the pucks is perfectly elastic. What can we say about the velocity of the pucks before and after the collision?

   b. Assume the collision is perfectly elastic. Determine the momentum and kinetic energy of the pucks.

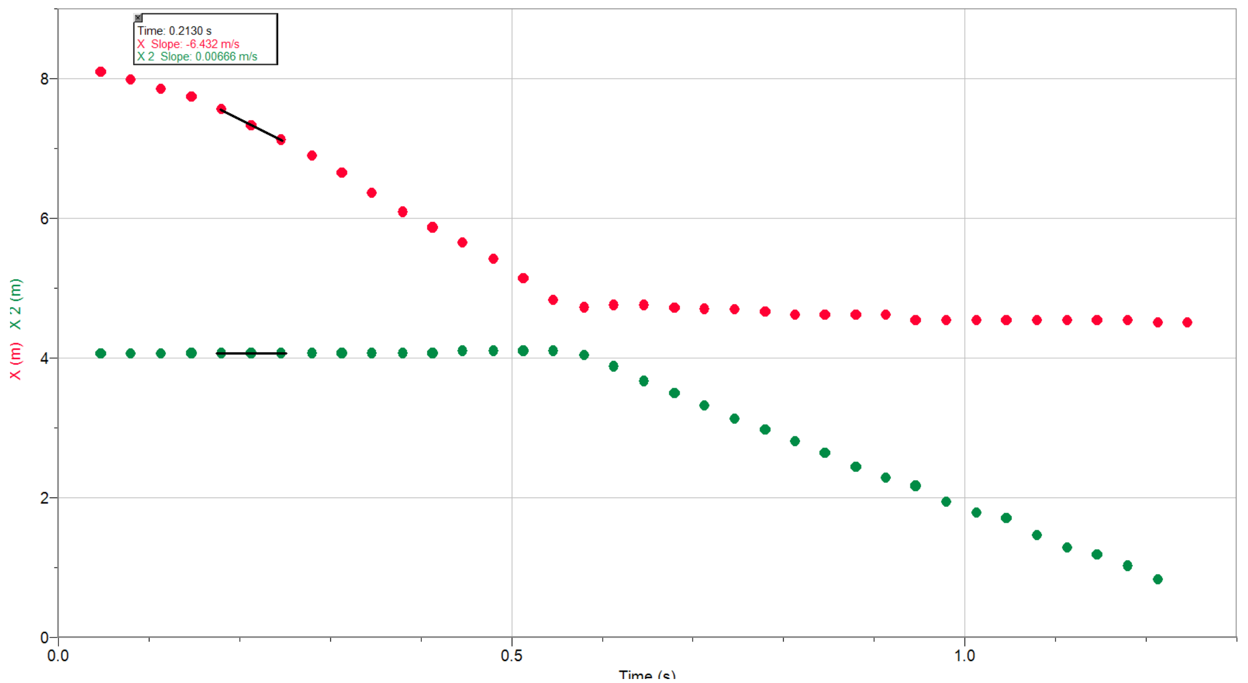
   c. Assume the collision between the pucks is inelastic and after the collision the velocity of the puck is observed to be only half the initial velocity. Determine the change in momentum and the change in kinetic energy of the pucks.

   d. If all the energy that was lost in the collision goes into heating the room how much kinetic energy is converted into heat energy? (give your answer in Joules)

   e. When we perform the demonstration do we expect the collision to be perfectly elastic? Why or why not?

   f. In any real world situation will any collision be perfectly elastic? Why or why not?

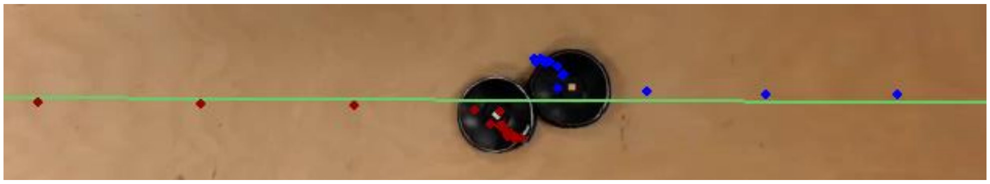
3. Again, we have two pucks. One is released with a velocity of -6.4 m/s towards the other one which is at rest. The path of the pucks is shown below:



a) Does this position-time graph represent the situation described above? Why or why not?

b) Describe the motion of the pucks seen in the graph above.

c) Assuming no losses to frictional forces (eg. Heat etc…) what should be the final velocity of the pucks? You should use words and equations in your response.



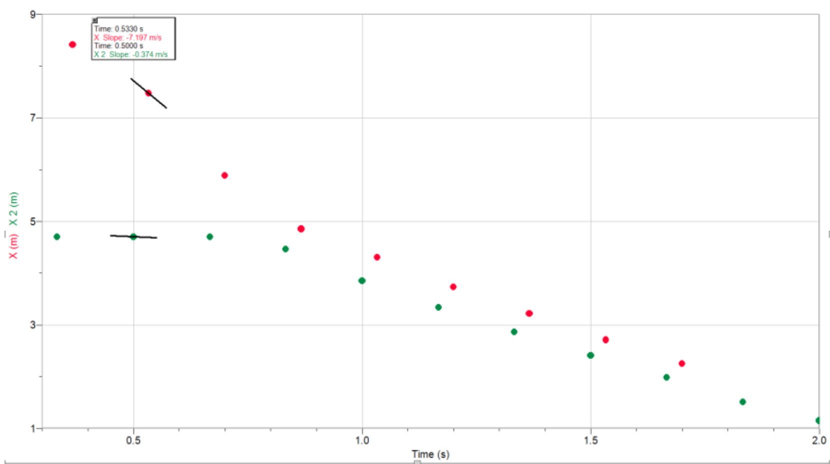
4.

Let's set the problem up the same way as before: two pucks of equal mass with equal but opposite velocities. This time we surround the pucks in Velcro so they stick together after the collision.

a. What do you expect to be the final velocity of the combined pucks?

b. Verify that momentum was conserved in the collision if the pucks have the final velocity you predicted (a).

5. Leaving the Velcro on the pucks we model the situation in (3). Again, we have two pucks. One is released with a velocity of –7.2 m/s towards the other one which is at rest. The path of the pucks is shown below:



a. Does this position-time graph represent the situation described above? Why or why not?

b. Describe the motion of the pucks seen in the graph above.

c. Assuming no losses to frictional forces (eg. Heat, etc…) what should be the final velocity of the combined mass? You should use words and equations in your response.