Conservation of Momentum (2D)

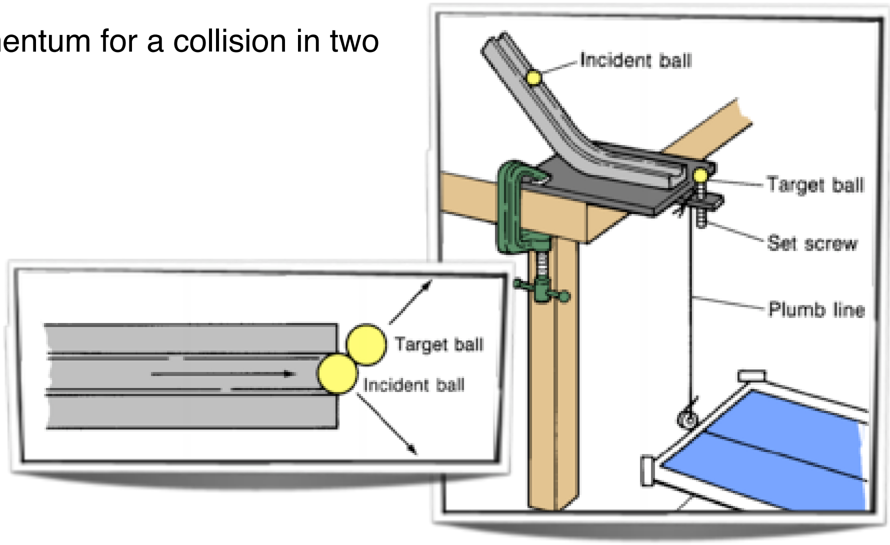
Name ____________________ **Date** ____________

Purpose

Investigate the conservation of momentum for a collision in two dimensions.

Materials

2 steel balls of equal mass
C-clamp
Ramp apparatus for a collision in two dimensions
meter stick
2 sheets carbon paper
4 sheets white paper



Procedure

1. Assemble the apparatus as shown. If your apparatus does not have an attached plumb line, a washer on a string suspended from the apparatus can serve as a plumb line. The set-screw at the bottom of the inclined ramp has a small depression in its top to hold the target ball. Adjust the depression in the setscrew so that it is positioned about one radius of the steel ball away from the bottom of the inclined ramp. Roll a steel ball down the inclined ramp and observe the ball as it travels over the set-screw. Adjust the set-screw so that the steel ball is just able to pass over it.

2. Tape four pieces of paper together to form one large sheet of paper. Arrange the center of one edge of the paper so that it is located just below the plumb line. Tape the paper in place on the floor. The spot just below the plumb line should be marked 0.

3. If your inclined ramp has an adjustable slider, move it about two-thirds of the distance up the incline and secure it. Otherwise, use a piece of tape to mark a position at this same point on the incline. Without placing a target ball on the set-screw, roll a steel ball from the marked position on the incline and let it fall onto the paper. Note where the ball lands and place a sheet of carbon paper there. Roll the incident ball ten more times from the same location on the incline; circle and label the cluster of points on the paper where the initial incident ball lands.

Place the target ball on the set-screw and release the incident ball from the marked position on the incline. Make sure that the two balls are at the same height above the floor at the time of collision. Try ten collisions between the incident and target balls, making sure that you release the incident ball each time from the same location on the incline. Circle and label the clusters of points where the incident and the target balls hit the paper.

Draw a vector from the point 0, under the plumb line, to a spot in the center of the initial incident cluster of points. This vector represents the initial momentum of the incident ball. Label this vector p initial Measure the magnitude of the initial momentum vector and record this value in Table 1.

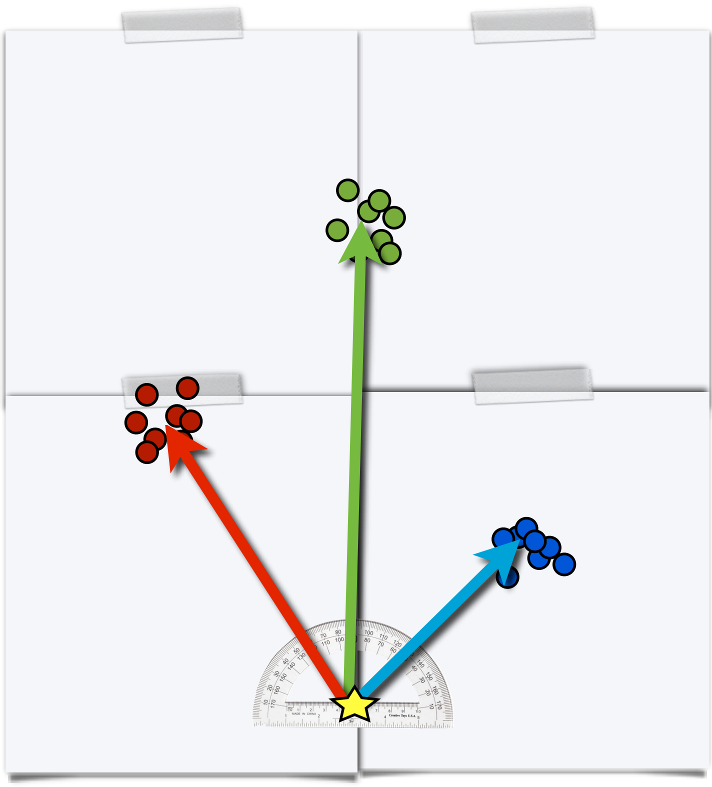
Draw a vector from the point 0 to a spot in the center of the cluster of points where each ball landed, as shown in Figure 3. Label this vector p final A and p final B. Measure their magnitudes and record this value in Table 1.

Grade

Conservation of Momentum (2D)

Name ____________________ **Date** ____________

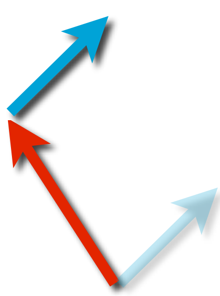
Observations and Data



Trial 1		
	Length	**Angle**
P_{af}		
P_{bf}		
P_i		

Trial 2		
	Length	**Angle**
P_{af}		
P_{bf}		
P_i		

Analysis



Use a ruler and protractor to add the two final momentum vectors head to tail. What is the total of the two vectors?

Use the component method to add the two final momentum vectors again.

Vector addition - Trial 1				
	Length	Angle	x	y
P_{af}				
P_{bf}				
Resultant			x=	y=
			p	θ =

Vector addition - Trial 2				
	Length	Angle	x	y
P_{af}				
P_{bf}				
Resultant			x=	y=
			p	θ =

Grade