

Name \_\_\_\_\_ Box # \_\_\_\_\_

Date \_\_\_\_\_ PER \_\_\_\_\_

### Honors Physics – Collisions in 2 dimensions

**Purpose:** To determine the horizontal velocity of a steel ball released from rest

**Materials:** ramp, steel ball, marble, carbon paper, white paper, protractor, meter stick

**Procedure:**

1. Measure and record the mass of a steel ball and a marble.
2. Place the marble on the support located at the bottom of the ramp. This ramp can rotate so that the marble is off center. Make sure the marble is NOT centered with the ramp.
3. Place the steel ball flush against the support at the top of the ramp and release.
4. Each ball should fall on the floor away from the point of release and at an angle relative to the initial released path.
5. Practice several times to get an idea of where each ball will land.
6. Tape a piece of paper on the floor where each ball lands.
7. Place (NO TAPE!) a piece of carbon paper on top of the white paper so as to record where each ball lands.
8. Reset each ball in its proper place and release.
9. Repeat step 8 five times.
10. Measure and record the height of the table.
11. Measure and record the horizontal displacement of EACH ball for each trial relative to the hanging bob.
12. Measure and record the angle of each ball for each trial relative to the hanging bob and the initial path.

**Mass of Steel Ball** \_\_\_\_\_

**Mass of Marble** \_\_\_\_\_

**Height of Table** \_\_\_\_\_

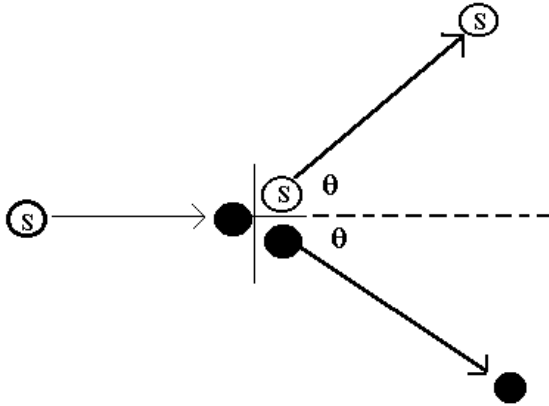
Trial	Horizontal Displacement		Angle	
	Marble	Steel Ball	Marble	Steel Ball
1				
2				
3				
4				
5				
Average				

**Calculations**

- Using the height of the table, solve for the time each PROJECTILE is in the air.
- Using the average **horizontal** displacement and the time, calculate the **horizontal** velocity for each ball. These velocities will be the RESULTANT velocities in the picture below.

Steel Ball	Marble

- The picture below shows a view as if you were looking down on the collision. The left side of the picture depicts what happens BEFORE the collision and the right side depicts what happens AFTER the collision. Place your values for the average angle and resultant velocities for each ball on the picture below. Break your resultant velocities into components and show them as well.



- In which direction (X or Y) did the collision **initially** proceed?
- Using **ONLY** the direction stated in #4, fill in the chart below and solve for the initial velocity of the steel ball.

$\Sigma p_x$ (Before the collision)				=	$\Sigma p_x$ (After the collision)			
Mass of steel ball	Velocity of Steel Ball	Mass of Marble	Velocity of the Marble	=	Mass of steel ball	Velocity of Steel Ball	Mass of Marble	Velocity of the Marble
		+		=			+	

- The actual velocity for a steel ball released from this height (using a photogate) is around \_\_\_\_\_ m/s (Teacher will provide this value) Calculate a % difference below.