Name: ________________________ Block: _______ Date: ____________

Predicting a Trajectory

Background: You can predict the landing point of a ball launched horizontally from a tabletop at any speed. If you know the speed of the ball as it leaves the table, the height of the table and the downward acceleration due to gravity you can predict where the ball will land. In this experiment, you will be utilizing the projectile equations and the concepts of motion in two dimensions to predict the spot where a ball will hit the floor when launched horizontally from a tabletop.

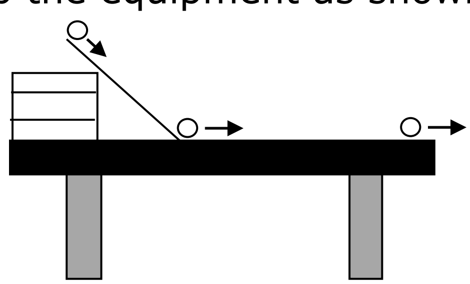
Problem: How can you predict the landing position of a projectile launched horizontally at any speed?

Materials:

Stopwatch	Meter stick
Ruler	Marble
Textbooks	

Procedure:

1. Set up the equipment as shown in the following diagram.



2. At no time is the ball to hit the floor during your experiment. You must catch the ball immediately as it rolls off the table. If the teacher hears the ball hit the floor, your experimental set up will be readjusted and you will begin again.

3. Record the time that the ball takes to roll across the table. It is necessary to know the horizontal distance the ball travels as it is timed. Also, if you are at a constant speed, the ball cannot be accelerating. Record the distance and time in the data table.

4. Repeat step three 4 more times and average your results. NOTE: Each trial should be set up and run the same way. There are several critical areas to watch out for here. Calculate the horizontal speed (v_x) of the ball.

5. Measure the height of the table and record the height.

6. Using the information in parts 4 and 5, show the calculations necessary to make a prediction on where the ball will hit the ground.

7. Mark the floor where you feel that the ball will hit the ground and then call the teacher over. You will then place a target on the floor and you will roll your ball across the table and shoot for the target. Part of the lab grade will be determined by how accurately you predicted the landing point.

Data:

Trial	Distance (m)	Time (s)	Velocity (m/s)	Velocity Calculations
1				$v_x = \frac{\Delta x}{t}$
2				$v_x = \frac{\Delta x}{t}$
3				$v_x = \frac{\Delta x}{t}$
4				$v_x = \frac{\Delta x}{t}$
5				$v_x = \frac{\Delta x}{t}$
Average				

Calculations:

X	y
	$\Delta x_y =$

Questions:

1. How would the predicted landing point change if you used an equal sized light wooden ball instead of the ball that you used?

2. If the angle of the ramp is increased, how would the predicted landing point change? Explain.

3. Why should the ball be started at the same point on the ramp each time?

4. List three potential sources of error in this lab.

5. How far would the ball have flown horizontally if the experiment had been done on the moon? The acceleration due to gravity on the moon is 1/6 of the acceleration due to gravity on Earth. SHOW WORK!

6. A student launches a ball with a velocity of 150 cm/s off of a table that is 0.9m high. The student finds that the ball hits the floor 4.0m from the end of the table. What is the acceleration due to gravity in the room where the experiment took place? (Hint: You must CALCULATE gravity!)

Marble Successfully Hit Target:	First Attempt	Second Attempt	Third Attempt
Teacher Signature	5 points	3 points	1 point