Lab – Projectile Motion

Purpose: To hit the bull's-eye!

Materials:

- Ramp
- Masking tape
- Ruler
- Meter stick
- Stopwatch
- String and washer
- Target and carbon paper

Instructions:

1. Tape the ramp so that the bottom of the ramp is 30 cm from the edge of the table's edge.
2. Set the ball at the top of the ramp and let it roll. As soon as the ball hits the table, start timing. When the ball falls off the edge of the table, stop timing. DO NOT LET THE BALL HIT THE FLOOR! Repeat this process ten times.
3. Create a data table to show the times for the ten trials. Calculate the average time.
4. Knowing the average time and the distance traveled, calculate the horizontal speed of the ball.
5. Measure the height of the lab table and record it in your lab book.
6. Knowing the height of the table, calculate the time it would take the ball to strike the floor if it was dropped off the table. Show all work, using the GUESS method.
7. Knowing the initial horizontal velocity of the ball and the time of flight, calculate the range of the ball as it rolls off the ramp on the table.
8. Hold the string with the washer tied to the bottom at the edge of the table to see where the zero point on the floor will be (this accounts for the table ledge). Place the bull's-eye of the target at the predicted range. Tape the target to the floor.
9. Call the teacher over. The teacher will place the carbon paper on the target. Release the ball from the ramp and see where it strikes the ground. Did you hit the bull's-eye?
10. For your conclusion, write about your results and the lab experience. Then answer the following questions:
    - How could you determine the range of a ball launched horizontally by a slingshot?
    - Assume you can throw a baseball 40 m on the earth's surface. How far would you throw the same ball on the moon, where the acceleration due to gravity is one-sixth what it is on the surface of the earth?
    - Will the assumptions made in the equations $d = vt$ and $d_y = v_i t + \frac{1}{2} at^2$ hold for a ping pong ball? If the table were 1000 m above the floor, could you still use these equations? Why or why not?