

221 Cannon Simulations (use the link to get to the simulation)

To receive credit for homework:

- Write all answers in your bound journal
- 2pt if you do not title the entry
- 2pt if you do not date the entry

YOU ALSO MUST

- 1) **Diagram each problem**
- 2) **Write down all known variables**
- 3) **$a = 9.8\text{m/s}^2$**
- 4) **all answers should have 2 significant figures**
- 5) **Write down the formula you wish to use**
 - a. (Formulas: $D_y=1/2at^2$ $V_y=at$ $V_x=D_x/t$)
- 6) **Then completely write all of your math problems for each problem**
- 7) **BOX your answers**

PART I: go to link and **CLICK LAB** to begin simulations

- 1) Using the equation $D=1/2at^2$, if an object was 3m high, how long would it take for an object to fall to the ground?
- 2) If a cannon is fired from 3m high at 0 degrees with a horizontal velocity of 15m/s, how far from the base of the cannon would the object land.
- 3) Conduct the **simulation** (pick your projectile: cannonball, car, human etc.) and compare your result with your answer from problem 2 (use time, range height guide)?
- 4) If you raise the stage to 10m, how long would it take for an object to fall to the ground?
- 5) If a cannon is fired from 10m high at 0 degrees with a horizontal velocity of 15m/s, how far from the base of the cannon would the object land.
- 6) Conduct the **simulation** (pick your projectile: cannonball, car, human etc.) and compare your result with your answer from problem 5?
- 7) If you raise the stage to 15m, how long would it take for an object to fall to the ground?
- 8) If a cannon is fired from 15m high at 0 degrees with a horizontal velocity of 15m/s, how far from the base of the cannon would the object land.
- 9) Conduct the **simulation** (pick your projectile: cannonball, car, human etc.) and compare your result with your answer from problem 8?

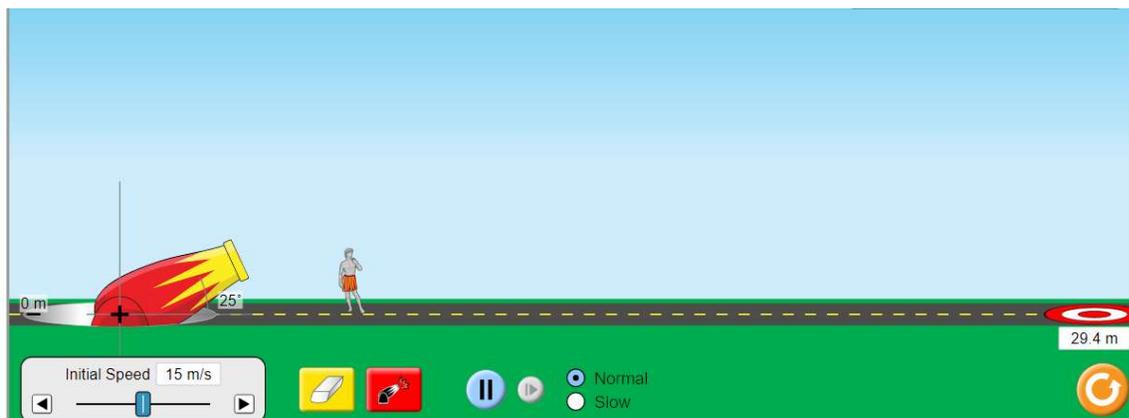


PART II:

- Pull the stage down to 0m high. Fire the cannon (15m/s) at the different angles and record the distance traveled for each.
- Using the time (range height guide), measure the height at the top of each curve, and record it in the table.

Cannon Degrees	Distance object traveled	Height at top of curve
20 degrees		
30 degrees		
45 degrees		
60 degrees		
80 degrees		
90 degrees		

- 1) Which angles have the same range distance?
- 2) Which cannon angle had the highest height?
- 3) Which degree shot the object the furthest?
- 4) Diagram the cannon shots for this exercise:



Part III: ***Equations for Projectile motion are on 221***

- 1) How long will it take a cannon ball to fall 5.0m ($D=1/2at^2$)
- 2) Test your answer by setting up the cannon to fire at 0 degrees at 28m/s , at 5.0m high
 - a) How long did it take to reach the ground?
 - b) How far did it travel in the X-direction?
 - c) Prove mathematically that the distance makes sense based on the time the cannon ball was in the air.
- 3) If you were to fire the cannon ball straight up at 19m/s you can determine the total time up (T_u) using the equation ($T_u = V_{yo} \div g$). V_{yo} = Velocity in the Y-direction at the origin or a time 0 (zero). What is T_u ?
- 4) The total time the ball is in the air would be $2 \cdot T_u$ (time it takes for the cannon ball to go up will be equal to the time it takes for the cannon ball to return to the ground)
What is the total time the cannon ball is in the air?

- 5) Set the cannon up to fire at 90 degrees at 19m/s.
 - a) What is the total time in seconds?
 - b) What is just T_u ?
 - c) If T_u is equivalent to time of free fall, how much time does it take for the cannon ball to return to earth?
 - d) Computer the Distance fallen using the equation ($D=1/2at^2$)
 - e) What is the maximum height (you must measure, with the tape measure)
- 5) If the cannon was to fire at 15m/s at 45° what would be the
 - a) V_{xo} ?
 - b) V_{yo} ?
 - c) What would be the T_u ?
 - d) What would be the time for up and down?
 - e) What would be the maximum in the Y direction (Y-max)?
 - f) What would be the maximum in the X direction (X max)?

6) Set the cannon up to fire the cannon ball at 45° at 15m/s. Using the value you determined for X_{max} , use the tape measure to measure out the distance in the x-direction and place the bulls-eye (make sure the target is on the horizontal line). Fire the cannon and see if your calculations are correct. Measure the Y_{max} and see if your calculations were correct.

- 7) Draw a diagram of problem #6 in your bound journal.