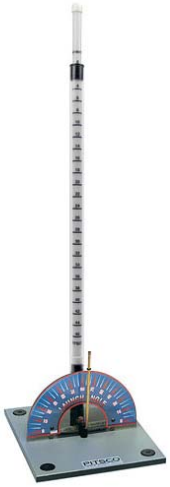
Optimal Launch Angle for Maximum Range and Velocity of a Projectile

CWM 2008 Workshop - Camden County High School – http://www.camden.k12.nc.us/cchs/
Becky Claggert - bclaggert@camden.k12.nc.us

Almost all of us have flown a paper airplane or thrown a softball; however, did you ever think about the angle in which you did so. The purpose of this workshop is to find the optimal launch angle for maximum range and maximum velocity of a projectile.



The workshop begins with the construction of the projectile. The projectile, which is a straw rocket, consists of a straw, index card, tape, and modeling clay. A Pitsco Straw Rocket Launcher (http://catalog.pitsco.com/store/detail.aspx?ID=2547&bhcp=1) which uses compressed air is used to launch the straw rocket.

Construction Procedure

1. Design and build rocket
    a. Using a 3x5 index card design and cut out the fin shapes
    b. Using a ¼" drinking straw attach the fins so they are evenly spaced around the end of the straw with transparent tape
    c. Soften the clay by kneading and shape nose cone
    d. Attach the nose cone on top of the straw making sure the outside edge is sealed with the clay so air cannot escape

2. Roll out the white bulletin board paper and set the rocket launcher at one end
3. Slip the completed rocket over the launch tube
4. Adjust the launch tube and rocket to the trajectory angle of 15 degrees
5. Raise the launch rod to the fifth calibration line
6. Release the launch rod so that it falls to the bottom of the cylinder
7. When the rocket launches start the stopwatch so it will time the rockets flight. Stop timing as soon as the rocket hits the ground.
8. Measure the rocket's range using the measuring tape, when the rocket lands the clay nose will make a mark on the white paper.
9. Using the data sheet, record the rocket's range and flight time.
10. Repeat steps 3-9 using trajectory angles of 30°, 45°, 60°, 75°, and 90°.
11. Complete the Varying Launch Angles Data Sheet
12. Using the Varying Launch Angles Data Sheet calculate the average velocity for each of the 12 launches and record on the Calculating Average Velocity Sheet. Average Velocity is the total distance traveled divided by the time.
13. Analyze the data generated from your test

The experimental procedure involves launching the straw rocket six times using the fifth calibration line on the rocket launcher. After each launch 15°, 30°, 45°, 60°, 75°, and 90° the distance the straw rocket traveled was measured and the time it traveled after being launched is calculated by using a stop watch.