

“Trajectory”: A Post-Visit Activity for Tragic Prelude (Grades 5-8)

Approximate time for activity: 20 minutes

Standards addressed with this activity:

(Next Generation Science Standards)

- **MS-PS2-2.** Plan an investigation to provide evidence that the change in an object’s motion depends on the sum of the forces on the object and the mass of the object. [Clarification Statement: Emphasis is on balanced (Newton’s First Law) and unbalanced forces in a system, qualitative comparisons of forces, mass and changes in motion (Newton’s Second and Third Laws), frame of reference, and specification of units.]
- **MS-ETS1-1.** Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Background Information: The cannon used at the Mahaffie Stagecoach Stop is an 1821 Mountain Howitzer, and was used by both sides in the Tragic Prelude to the Civil War. The advantage of using cannons over rifles was clear. They could shoot up and over a barrier (which was often the soldiers on the same side) and still hit the target, if the trajectory was properly calculated. Trajectory is defined as the path in which an object travels in an arc.

There are 3 things that affect trajectory. (The last 2 factors are ones we can change.)

1. Gravity acts on the ball and pulls it consistently toward earth, forming the arc. Gravity cannot be altered, but you can compensate for its pull.
2. The amount of gunpowder (charge) put in the cannon affects how far it will travel.
3. The angle of the barrel can make the arc higher or lower in its travel toward the target.

Analysis:

1. In the drawing to the right, there are two arcs of trajectory drawn, both hitting the ship in the water. Using the information above, identify which 2 factors may have been responsible for the change in trajectory.



- Using the information above, look at the drawing to the right, and give two reasons why cannons, rather than rifles, would be useful on this battlefield.

a. _____

b. _____

Extension Ideas:

- Design an experiment to gather data on trajectory. Use rubber band cannons to alter force, and trajectory to hit a specified target. Use data table input to decide how to alter the set up.
- Go to this interactive website and see what other variables might affect trajectory:
<http://phet.colorado.edu/en/simulation/projectile-motion>

Questions:

What was the angle required for this cannon to hit the target?

What is not realistic for this simulation? (Even if you change the object, the other variables don't change, and they should.)