LONG MAY IT WAVE:

Fort McHenry
and the War of 1812

A National Curriculum for Grades 4 through 8

LESSON TITLE: Cannons During the War of 1812

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COURSE/GRADE: Science, Adaptable to Grades 4-8
UNIT: Simple Machines
TIME NEEDED: One 45-minute class period

LESSON OVERVIEW:
Students will explore how cannons work and use a computer simulation to explore the issues of angle and velocity.

OBJECTIVES: At the end of this investigation students will be able to:
- Explain why cannons work
- Explain how cannons worked to protect Baltimore in the war of 1812

Maryland State Curriculum Content Standards for Science (Grade 4):
1.A.1 Gather and question data from many different forms of scientific investigations which include reviewing appropriate print resources, observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments.
1.B.1.a Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations.
5.A.1 Describe the motion of objects using distance traveled, time, direction, and speed.
5.A.1.a. Observe, describe, and compare types of motion.
5.A.1.b   Use measurements to describe the distance traveled as the change in position.
5.A.1.c Based on data describe speed as the distance traveled per unit of time.
5.A.2. Explain that the changes in the motion of objects are determined by the mass of an object and the amount (size) of the force applied to it.
5.A.2.a   Observe and give examples that show changes in speed or direction of motion are caused by an interaction of forces acting on an object: friction, gravity
5.A.2.b Observe and explain the changes in selected motion patterns using the relationship between force and mass.

Maryland State Curriculum Content Standards for Math (Grade 4):
4.A.1.b Organize and display data to make tables using a variety of categories and sets of data.
4.B.1.a   Interpret data contained in tables using a variety of categories and intervals.
6.A.1.a   Read, write, and represent whole numbers using symbols, words,   and models

MATERIALS:

- Computers for each student, open to http://jersey.uoregon.edu/vlab/Cannon/
- Activity sheet
- Enrichment sheet
- Sketch of Fort McHenry

VOCABULARY:

velocity
angle
gravity
windage
density
cannon

PROCEDURE:

1) Warm Up

- Have students draw a picture of a cannon.
- Beneath their pictures, ask students to list what they know about how cannons work and the role of cannons in war.

2) Engagement

- Have students share what they know about cannons.
- Explain that today we are going to talk about the roles of cannons specific to Fort McHenry and the Battle of Baltimore, and we will also explore what affects the cannons accuracy.

3) Exploration

- If available, have students at separate computers, either individually or in groups of 2-4, and have them log into this website: http://jersey.uoregon.edu/vlab/Cannon/ (If computers are not available for every student, log into the website yourself and do the simulation as a class.)
- As students navigate through the simulation, they will answer questions on an activity sheet.
- Define the words:
    - o   Angle: The slant at which the cannon is placed to hit a target.
    - o   Velocity: The speed at which an object travels
    - o   Gravity: The force that pulls an object to the ground.
    - o   Windage: The speed of the wind
    - o   Density: the denseness of the object that is moving.
- Have students manipulate the computer simulation to hit the target by changing the angle and velocity.   They do not need to change the gravity, but they can.
- On their Activity Sheets, students will record their angle, velocity, whether they hit the target, and whether their shot was short or long.

4) Explanation

- On the stormy night of September 13-14, 1814 during the War of 1812, British warships fired approximately 1,500 bombs and rockets at Fort McHenry using cannons and mortars. They wanted to force the fort to surrender so that they could sail past it into Baltimore Harbor to attack the city. Fortunately for the Americans, according to Major George Armistead, the commander of the Fort during the battle, only about 400 of the bombs and rockets landed on the fort.
- You can show the attached image of the bombardment to enhance!
- Ask students: Why do you think only about 25% of the shots fired reached the fort? What affected the effectiveness of the cannons and mortars? (Responses include: the difficulty of precisely measuring distances, angles, and velocities; the fact that the cannons/mortars were on ships bobbing up and down in the water; the influence of a heavy wind; difficulties with visibility created by the rainstorm, etc.)
- Explain: The angle at which the cannon is pointed, with the velocity of the cannonball along with the pull of gravity and the wind effects the accuracy of the cannonball.

5) Enrichment

- Students will go back to the activity sheet, and use the simulator to answer the enrichment questions. This activity sheet will give an angle or velocity, and they will have to find the value of the other to hit the target.

6) Evaluation:

- In their journals or as an exit ticket. Have students answer the following questions:
  - What affected the accuracy of cannons?
  - What did you learn about the accuracy of a cannon dependent on the velocity and the angle?
  - How did the variables affecting the accuracy of cannons help or hurt Fort McHenry during the Battle of Baltimore?

Activity Sheet
"How do Cannons Work?"

Name:_____

Group Members:_____

Materials Needed:
This Sheet
A computer set to this website: http://jersey.uoregon.edu/vlab/Cannon/

Directions:
Log onto the website given above.
The goal of this simulation is to adjust the angle and velocity of your shot to hit the target.
Complete 5 different trials. Record the information for each trial in the chart below:

Trial	Angle	Velocity	Hit (Y/N)	Short/Long
1				
2				
3				
4				
5				

Based on your trials, answer the following questions:
1. Did you hit the target in any of your trials?

2. How did you change the angle or velocity in order to hit the target?

3. If a British ship was anchored 4 miles away from Fort McHenry on a stormy night, what would its gun crews have had to take into consideration while firing cannons?

4. Do you think the cannon was an effective weapon during the War of 1812?

Enrichment Activity

Directions:

You will be provided with either the angle or the velocity of the cannon/cannon ball. You will have to figure out the unknown to achieve a hit. In the last row, create your own.

Angle	Velocity	Hit?
60°		Y
	80	Y
	65	Y
50°		Y
		Y

1. What did you notice about the relationship between the angle and the velocity of the cannonball when it hit the target?

2. How did you change your calculations when you were trying to hit the target?

3. If you knew the velocity, how might you find the angle in which the cannon would need to be shot at?

4. How would explain this to a soldier in the war of 1812?

5. Do you think the distance of the target affects the effectiveness of a cannon?