

Chemical Processes: Build an Alka-Seltzer® Cannon

Target Grade Level: 5th-8th

Time for Lesson: 90-120 minutes

Overview & Major Themes

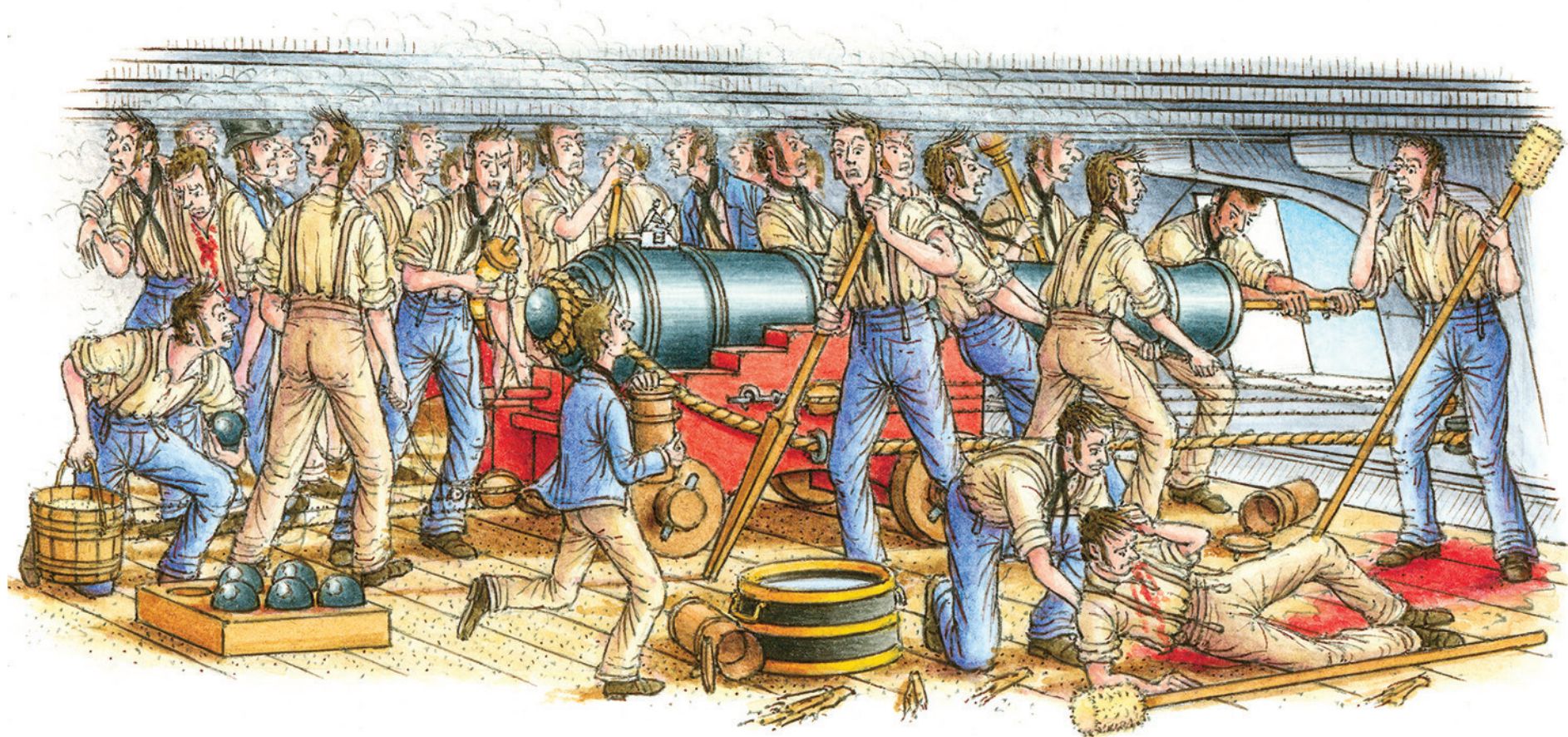
In *Chemical Processes - Build an Alka-Seltzer® Cannon*, students will experiment using the Scientific Method to produce a chemical change using Alka-Seltzer® tablets. Students will apply the chemical change and reaction to a challenge of loading and firing a gun, and understand the reality faced by sailors during the War of 1812 on board *Constitution*.

Objectives	Outcomes	Materials & Resources
<p>Students will learn, apply, and log the steps of the Scientific Method.</p> <p>Students will change the variables of this experiment at least twice to alter the final reaction.</p> <p>Students will produce at least 1 chart to track their results.</p>	<p>Students will conduct an experiment where they examine the effect of variables for the state of matter (physical state of the Alka-Seltzer® tablet, change of amount of Alka-Seltzer®).</p> <p>Students will compare and contrast their material, and apply their conclusions from their experiment.</p>	<ul style="list-style-type: none"> • An empty 35mm film container (a Mini-Pringles® can, anything with a small diameter and with a plastic top might work, like a Mini-M&M container, Salt and Pepper shakers with a plastic top, etc.) • Sugar cubes • Plastic cups • Alka-Seltzer® tablets • Warm water • Safety glasses • Stopwatch • White board/chalk board • Outdoor environment or large room (where nothing can break or no one will be injured with a propelled plastic top) • <i>Gun Deck in Battle</i> scene from <i>Explore Old Ironsides</i> • <i>Load and Fire a Cannon</i> Game or PDF

Time	Instructional Activity
2-3 min.	Begin the lesson with students with a review of the Scientific Method (Question, Hypothesis, Materials, Procedures, Data and Analysis, and Conclusion).
5 min.	Fill two cups halfway with warm water and place a sugar cube in one and Alka-Seltzer® in the other. Students observe the difference between the reactions of the solids when placed in the water.

Time	Instructional Activity
10 min.	Record the reactions on the board in a chart with students. Propose hypotheses: What will happen if the sugar cube/water is covered while it dissolves? What will happen if the Alka-Seltzer® is covered while it dissolves? Alka-Seltzer® does not dissolve calmly, but as a chemical reaction. What safety practices should be followed to conduct a safe test with this type of reaction?
5 min.	Use safety glasses to perform the experiment. Perform the experiment: fill 2 plastic-covered containers $\frac{1}{3}$ full with warm water, and add a sugar cube to one. Wait. Record observations with students.
5 min.	Now add the $\frac{1}{3}$ Alka-Seltzer® tablet in the other container and quickly pop the lid back on the container. Place the container (top up) on the ground and take five large steps back (make sure students are far away). If it takes your cannon more than twenty seconds to fire, carefully re-try the experiment. It will make a loud noise and the lid will pop off, shooting into the air. Avoid setting the canister directly below light fixtures, because the lid may be able to break light bulbs.
10 min.	Record observations with students. Explore the differences between the two reactions. Why would the top pop? How high did it go? The gas (carbon dioxide) formed when the Alka-Seltzer® tablet dissolves builds up pressure inside the sealed container until the enclosed area cannot contain it. The point of least resistance will pop.
20 min.	Adding VARIABLES: Re-try the experiment with another Alka-Seltzer® tablet, using a $\frac{1}{2}$ tablet and then a full size tablet. Try it with a crushed tablet or try setting a timer to record the amount of time the plastic top takes to pop. Your control: make sure the amount and temperature of water is the same. Record observations after every added variable experiment.
20 min.	Some questions to explore with students: Which variable sent the plastic top highest or furthest? Which variable popped off faster? Why?
20 min. & Homework	Draw a comparison between the crushed tablet vs. the whole tablet; the $\frac{1}{2}$ tablet versus the whole tablet, etc. Have students chart graphs of results and complete their report with their conclusions.
10 min.	Share with students the Gun Deck in Battle scene. Ask them to make comparisons between what they observe in this scene and the experiment they performed. What were the dangers and safety features they used versus the dangers and safety features the sailors used while firing a gun in 1812?
10 min.	Play the <i>Load the Gun</i> game or use the PDF of <i>Loading and Firing a Cannon</i> with your students. Compare the materials used in their Alka-Seltzer® experiment to the materials needed to fire the gun on <i>Constitution</i> .

Gun Deck in Battle



Roaring and belching fire, *Constitution's* guns were like huge and dangerous dragons when the enemy drew near. Seamen fed their smoking mouths with gunpowder and iron. Thick ropes controlled them, yet with every shot they jerked and lurched, threatening to break loose. Constant training taught each member of the gun crew his job in handling these hot, heavy beasts. Yet nothing could really quite prepare him for the smoke, the noise, the blood and the deadly flying splinters of the gun deck in battle.