A.D. HENDERSON &
FAU HIGH SCHOOL

777 GLADES ROAD
BLDG #26
BOCA RATON, FL 33431

THE
CANE
INSTITUTE
FOR
ADVANCED
TECHNOLOGIES

Hello ADHUS and FAUHS Students (and Parents)!

The Cane Institute (TCI) is excited to bring you a fun aerospace activity for your third TCI STEM@Home kit, Alka-rockets!!! There is nothing like a little rocket science to add some excitement to the day! Remember to share your experience with our TCI learning community by posting pictures to The Cane Institute Facebook and Twitter sites! Be a part of our SOCIAL MEDIA CHALLENGE!!!

For this activity, we ask that you add your data to the following Google Form. https://forms.gle/F25z4HLNMvQCcfMr8 We will combine ALL your data and share the graphs created by posting to social media. This will help show the value of collaborating with others, using LARGE data sets, and repeating experiments multiple times to better understand a scientific phenomenon. Here is a link to the standards addressed for each grade level through this experiment: https://tinyurl.com/yxasrlsm.

In this experiment, you will manipulate **one variable**, the amount of water in the film canister. You will launch with the rocket full of water, ¾ full, ½ full, ¼ full, and with only 3 mL of water. For each launch, you will use one half of an Alka seltzer tablet. BEFORE YOU START, how much water will launch your rocket the farthest? **Create your hypothesis!**

MATERIALS:

- safety glasses
- marker
- ruler
- film canister
- drinking straw
- string (5 meters long)
- tape
- graduated disposable pipette
- water
- Alka seltzer tablets (broken into halves)

PROCEDURE:

Safety glasses are required for this activity. Make sure you have adult supervision. This activity must be done outdoors. In this directed experiment, we will launch our rockets horizontally along a string to accurately measure the distance traveled by the rocket as we manipulate **one variable** (the amount of water for each launch).

1. Use the marker and a ruler to divide the film canister into quarters by marking lines on the side. This will be used to measure the quantity of water used for each launch.
2. Tape the piece of straw to the film canister so the straw is parallel to the canister. (Make sure you leave enough room for the lid!)
3. Slide the string through the hole of the straw so that the lid of the canister is facing the opposite direction of the string's path.

4. Tie one end of the string to a stationary object such as a fence post, lawn chair, or light pole. This will be your launchpad. Have an adult hold the other end of the string taut and level. Everyone MUST put on safety glasses before continuing to Step 5!
5. Fill the film canister with water almost to the top, drop in ½ of an Alka seltzer tablet, and quickly close the lid. The film canister should have the cap next to the stationary launch pad. NO ONE should stand behind the canister.
6. After a short period of time, the lid will pop and send the canister down the string. Measure the distance traveled and record your results on the Google Form https://forms.gle/F25z4HLNMvQCcfMr8
7. Repeat steps 5 and 6 above but manipulate the volume of water in each launch. Each launch should use ½ of an Alka seltzer tablet. Keep all other conditions the same. Use ¾ full, ½ full, ¼ full, and 3 mL (one of the graduated disposable pipettes full) of water for each of the next four launches. Measure the distance and record your results on the Google Form link above.

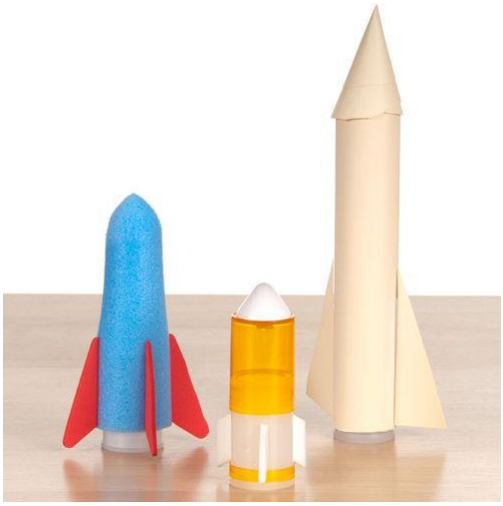
WHAT IS GOING ON???

As the Alka seltzer tablet fizzes, many, many bubbles of carbon dioxide gas are released inside the canister. Pressure from the gas builds. Since the lid is the weakest point of the canister, eventually the lid pops off and all that gas comes rushing out of the end of the canister. This action can be explained using Newton's Laws of Motion. This is an example of Newton's Third Law of Motion – "Every action has an equal and opposite reaction". The gas rushing out of one end of the canister (the action) causes your rocket to move in the opposite direction (the reaction). This is exactly how all rockets work whether you use an effervescing tablet as your fuel or a chemical rocket propellant like they do at NASA. The thrust, or push, of your rocket is related to how much pressure built up inside the canister before the lid popped off.

MAKE IT AN EXPERIMENT!!! How High Can You GO?

Did you know??? The GUINESS WORLD RECORD Alka seltzer powered rocket soared to 269 meters (883 feet)!!! That is taller than a 60-story building! How far can you get your rocket to fly? Try modifying your rocket to see if you can improve its flight. Remember, when you are conducting experiments you only want to change one thing at a time. Keep everything else the same to see how the thing you changed (or the variable) affects the outcome (your rocket going up into the air). You may want to do some research online on Alka-Rockets to help inform your experiment. Try answering some of these questions:

1. Does water temperature affect how fast the rocket launches?
2. Does the size of the tablet affect how long it takes for the rocket to launch? Try crushing the tablet.
3. Does the temperature of the water (hot or cold) affect how fast the rocket launches?
4. Does adding a nose cone improve the rocket's flight?
5. Does adding fins improve the rocket's flight?
6. If the height of the rocket is based on building up pressure until the lid pops off, is there a way to build up more pressure prior to launch?
7. Can you get similar (or better) results from another fuel source such as vinegar and baking soda? Mentos and Diet Coke?
8. Try adding a payload (such as taping quarters, one at a time, to the top of the film canister) and see how the mass of the rocket affects the flight height with one quarter on board, two quarters, etc.



SOCIAL MEDIA CHALLENGE!

Post stories and photos/videos of you and your rockets on The Cane Institute social media for a chance to win prizes!!! To be eligible, please post on our Facebook and/or Twitter page before Friday, October 9, 2020. Search for FAU Cane Institute on Facebook or @FAUCaneInstitut on Twitter.