Pop Rockets

BACKGROUND
Rocketry is a fun way to teach youth about physical science: specially, Newton’s laws of motion. A rocket is really just a chamber full of gas under pressure. A small opening or nozzle in the chamber allows the gas to escape, propelling the chamber in the opposite direction. Rockets have been used for celebrations (fireworks), battle, and for exploration. This activity will help youth understand how rockets move by designing rocket fueled by antacid tablets.

This lesson will demonstrate the three laws of motion. The rocket lifts because it is acted upon by an unbalanced force produced when the lid of the canister is blown off by the gas produced by the antacid tablet (first law). The rocket is propelled upward with a force that is equal to the downward force propelling the water, gas, and lid (third law). This force is proportional to the mass of the water and gas expelled from the canister (second law).

INTRODUCTION
The science of rocketry began with Sir Isaac Newton, a famous scientist that lived during the 1600’s. Newton discovered three principles, or laws about motion. These laws are known as Newton's laws of motion.

The first law states that: Objects at rest will stay at rest, or objects in motion will stay in motion unless acted upon by an unbalanced force. For example, when you hold a ball in your hand, your hand is preventing the ball from being pulled down by gravity. When you unbalance the force of your hand by dropping the ball, what happens? The ball went from a state of rest to a state of motion when your hand “unbalanced” the force of gravity.

The second law states that: The acceleration of an object is directly related to the force exerted on that object and oppositely related to the mass of that object. This means that in able to make the rocket go higher, scientists need to design...
rockets that are as light as possible, with as strong an engine as possible. This is why they use engine stages. After the first engine is used up, it separates from the rocket to make it lighter.

The third law states: For every action there is always an opposite and equal reaction. For rockets, the action is when the gas comes out of the rocket. The reaction is when the rocket moves in the opposite direction (upward).

Now we are going to design and build a simple rocket to demonstrate these laws of motion.

WHAT TO DO
You have just been hired by NASA to design and build a rocket powered by antacid tablets. When tablets dissolve in water, they give off a gas. This gas is what will power your rocket. You will have one sheet of paper to create your rocket. Your rocket will consist of a cylinder, cone, and 3-4 fins. The cylinder should fit snugly around your film canister (make sure that the lid of the canister faces downward). To make the cylinder, wrap a tube of paper around the canister and tape is securely into place. Next, decide on the shape and style of your fins. Cut out your fins and attach the cylinder. Last, you will need to create the nose cone. This is easily done by cutting out a circle, and then by cutting a wedge from the circle, and overlapping the cut edges to form a cone.

To launch the rocket, it is best to work outside. Be sure to wear eye protection. Turn the rocket upside down and fill the canister 1/3 full of water. Next, drop in ½ of an antacid tablet. QUICKLY snap the lid shut. Stand the rocket upright on the launch pad and stand back.

TALK IT OVER
Sharing-
• What surprised you most about these experiments?

Processing-
• What problems did you have with the experiments?
• What did you learn from these experiments that you didn’t know before?

Generalizing-
• How will learning about rockets benefit you in the future?

Applying-
• How do the three laws of motion apply to this rocket?
• What would you do differently if you did these experiments again?

ENHANCEMENT
• Conduct a contest to see which rockets fly the highest. Tape a series of marks along a high wall and observe which rockets go past the highest mark.
Conduct experiments to see how different factors affect how high the rocket flies. Factors that you may want to test include: amount of water in the canister, temperature of the water, amount of tablet used, length of the rocket, etc.

**TRAINER TIPS**

- Most camera shops, pharmacies, or other stores that process film will donate canisters for educational purposes. Just be sure to ask in advance to make sure you have enough.

- When discussing the three laws of motion, it is helpful to have a model rocket to demonstrate.

- Be sure to conduct a launch pad area, and have the students who are not launching rockets to stand well away from the launch pad.