Alka-Seltzer Rockets

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Subject: Physics
Level: 4th grade to 8th grade
Standards: Next Generation Science Standards *(nextgenscience.org)*

MS-PS2-2 Plan an investigation to provide evidence that the change in an objects motion depends on the sum of the forces on the object and the mass of the object.

MS-PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

Schedule: Two 60-minute class periods

Objectives:

Students will learn how a rocket works by constructing one using a film canister and using an alka-seltzer tablet as fuel. They will observe how the laws of motion apply to their rocket and will investigate how a variable might affect the flight of it.

Students will

- Be introduced to the basics of how a rocket works.
- Learn physics vocabulary terms.
- Learn about the chemical reaction that produces the gas.
- Learn what a variable is.
- Plan, an experiment to test the effect of a variable on the flight of their rocket.

Vocabulary:

Chemical Reaction
Force
Thrust
Variable
Newton's Laws of Motion
Gravity
Dependent Variable
Independent Variable

Materials:

For Class:
Tape
Glue Sticks
Paper
Colored Pencils
Scissors

For Each Student:
Film Canister
Alka-Seltzer Tablet
Safety Goggles
Design Sheet
Activity Sheet

Provided By Teacher:
Meter stick

Safety:

Students should wear goggles while launching rockets.

Science Content:

History:
Rockets were invented during the 13th century in China. They were originally used for warfare, but have been developed to launch objects and humans into space.
For more info: http://www.grc.nasa.gov/WWW/k12/TRC/Rockets/history_of_rockets.html

How a Rocket Works:
Rockets use gases to provide a force to lift them up. Our rockets get the gas from a chemical reaction. Inside the alka-seltzer tablet is an acid and a base. When you add water, the acid and base react and give off carbon dioxide gas. The gas builds up in the canister and pushes on it. Once there is too much gas, the force of it pushes off the cap. The force of the gases pushes down on the floor, but the rocket goes up in the air. This is because the ground pushes back with an equal force. This is known as Newton's 3rd Law of Motion. You'll notice that the rocket does not move until a force is applied to it. This is Newton's 1st Law of Motion. The rocket should keep going on forever, however air resistance and gravity slow the rocket down and eventually cause it to fall back to the ground. If you put more alka-seltzer in the canister, it would produce more gas and more force. This would make the rocket fly up faster and higher, which is Newton's 2nd Law of Motion.
For more info: http://curious.astro.cornell.edu/question.php?number=681

Experimenting with Rockets:
A variable is something you change on an object. The students should list some variables after launching their rockets (amount of water, amount of tablet, number of fins, tube length . . .). Have them pick one variable to test and see how it affects the height of the rocket launch. They can hypothesize, test, collect data, graph data, and analyze their results.

Assembly Instructions

1. Have the students make a paper tube around the canister and tape it (they can decide the height of the tube. Make sure that their tube will not interfere with closing the lid of the canister.

2. Have them follow the directions on the design sheet to make the nose cone and fins.

3. Students can decorate their rockets any way they like.

4. Have them launch their rockets (one at a time so they can see other students design ideas) and then work on their activity sheet.

5. Students use finding to design a final rocket. Have a competition to see whose rocket flies the highest

Preparation:

1. Photocopy print materials (*Design and Activity Sheets*) for each student.
2. Distribute materials evenly to each student pair.
3. Set up launch site range.

Classroom Procedure:

Engage (Time: 20 mins)

Discuss the history of rockets and how they work. Show what happens to an alka-seltzer tablet reacts when put in water. How can we use this? Show a rocket working and discuss physics behind it.

Explore (Time: Varies)

Provide each student with their materials. They will need to design and build a rocket. Inform students that there will be a competition to see whose rocket can go the highest. Allow them to research designs on the internet. For younger students, you can provide examples from the websites listed in the resources. Encourage students to discuss the physics principles and vocabulary they learned as they construct their rockets to increase their understanding.

Have students work on activity sheet to find out how a variable affects the flight of their rockets. Share as a group some of the findings.

Set up launch site and have students test to see whose rocket goes the highest. You can use weight (payload) as a tie breaker.

Explain (Time: 10 mins)

Discuss with students what did and did not work, have them explain why certain settings worked better than others. Distribute Activity Sheet 3: Catapult Science Challenge Questions as a homework assignment to each student. Allow the students to work on it with a partner. During the next class period, discuss the challenge questions and clear up any misunderstandings the students may have about the concepts they learned.

Assessment:

The following rubric can be used to assess students during each part of the activity. The term “expectations” here refers to the content, process and attitudinal goals for this activity. Evidence for understanding may be in the form of oral as well as written communication, both with the teacher as well as observed communication with other students. Specifics are listed in the table below.

1= exceeds expectations
2= meets expectations consistently
3= meets expectations occasionally
4= not meeting expectations

	Engage	Explore	Explain
1	Shows leadership in the discussion and offers creative ideas reflecting a good understanding of the physics behind the catapult.	Completes work accurately while providing an explanation for what is observed. Works very well independently.	Provides an in-depth explanation of findings, making good use of vocabulary terms. Fills out worksheet clearly.
2	Participates in the brainstorm and shows an understanding of the physics related to the catapult.	Completes work accurately and works productively.	Provides clear explanation of findings. Fills out worksheet clearly.
3	Contributes to the brainstorm, but shows little understanding of catapult physics.	Works independently, but makes some mistakes with the procedure.	Provides a limited explanation of findings. Fills out some of the worksheet.
4	Does not participate in brainstorm. Shows no understanding of catapult physics.	Has trouble staying on task. Does little to complete the procedure.	Is not clear in explanation of findings. Does not fill out worksheet.

Extension Activities:

- Have the students build matchstick rockets. I find using paper matchsticks works better:

  http://www.grc.nasa.gov/WWW/k-12/TRC/Rockets/match_rocket.html

  http://www.youtube.com/watch?v=woUHXfPlwMY

Web Resources:

Safety:

- Make sure students wear goggles when launching rockets.