Rockin' Rockets Teacher Guide

OBJECTIVE

- Explore the forces that interact with a rocket to defy gravity.

CONCEPTS COVERED

- Newton's Laws of Motion, Thrust, Propulsion

SCIENCE PRACTICES

- Engineering and Design, Measuring

STANDARDS ADDRESSED

- 3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
- 4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.

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How to Use This Guide

This video is an introduction to how rockets work; defining concepts like thrust and Newton's Laws of Motion. Your students will watch the *Rockin' Rockets* video and will have access to the Student Guide that accompanies the video. The Student Guide includes a materials list and a procedure list to help them to recreate the experiment and to follow along with the experiment. The materials are all simple items they can find in their homes. If your students are not able to gather the materials to follow along with the experiment, they can observe the instructor conducting the experiment and its results. They will still be able to answer the reflection questions which are located at the end of the Student Guide. We have included those questions in the Teacher Guide with the answers. There are vocabulary words in the guide which students can refer to when any new concepts have been introduced. At the end of the Teacher Guide there are some links to other related NYSCI resources to extend the learning. We hope this video and guide can add some enrichment to your *Rockin' Rockets* exploration.

Video Synopsis

In this video, students can follow along to explore the concepts of Newton's Laws of Motion by doing different experiments. Each experiment allows students to observe how they can use Newton's Laws of Motion to launch a paper rocket.

Activity 1 illustrates the concepts of Newton's Laws of Motion, thrust and propulsion. Students will get the opportunity to design a straw rocket, measure how far their rockets travel, and collect data.

Activity 2 enables students to explore the concepts in the first experiment further by creating a stomp rocket, collecting data, and comparing the results in this experiment to the first experiment.

To get the most out of any science activity, students should be encouraged to follow their inquiries, further investigate, reiterate their rocket designs, and create their own experiments. They can try the activities with different materials or different methodology and compare results, as well as use this video as a launching point to create their own paper rocket experiments based on the additional questions that arise for them.

Background information

Motion is the process of something moving or changing place, or even just changing position. There are some laws that govern how motion works that are important for us to understand. We call these "Newton's Laws of Motion," named after the man who developed them, Sir Isaac Newton. The first law states that an object in motion will stay in motion unless acted on by other forces. This means that if you throw a ball it should stay soaring through the air forever. The reason it doesn't do that is because other forces, such as gravity and air resistance, slow the ball and drag it back

down. The second law states that the greater the mass of an object, the more force needed to accelerate it. Basically, this is saying that if you want to throw a big heavy object, like a rock, you'll need a lot more energy and force than you would if you're throwing a small, light object like a cork. The third law states that every action has an equal and opposite reaction.

The way rocket ships defy gravity is simply by using a lot of power. In fact, when we went to the moon in 1969, NASA sent Neil Armstrong, Buzz Aldrin, and Michael Collins into space with 4,578,000 lbs. of fuel! That is so much, but it's necessary for the rocket to get enough thrust. Thrust is a force that moves the rocket through the air and through space. Thrust is created by the propulsion system which uses Newton's 3rd Law to achieve liftoff. As the rocket fuel is burned up in that propulsion system, it creates gas that pushes against the ground underneath the rocket. Since there is nowhere for the gas to go besides to the immovable ground, the gasses end up pushing so hard that they push the rocketship up, all the way into outer space.

Check out more activities at www.nysci.org.

Troubleshooting Tips

Activity 1: Straw Rockets

- Making the straw rocket body can be a bit fiddly! Learners who struggle with fine motor skills may need an adult to help them form the tube around the straw.
- When your straw rocket body and nose are complete, test it on your straw before going to the next step. When you blow into the straw, put your hand in front of the rocket to feel for escaping air. Use as much tape as you need to ensure the air isn't leaking out.
- Sometimes a well-built rocket won't launch because of its placement on the straw. If you are certain no air is leaking out, but your rocket still isn't going anywhere, try adjusting how far back on the straw is placed.

Activity 2: Stomp Rockets

- Like the straw rocket, these also can be fiddly! Students may need a little help keeping the straw in position as they apply tape.
- Once the straw is taped, blow up the juice pouch and squeeze the air out towards your hand, so you can feel if any air is leaking through the tube (besides the straw). Add more tape to cover leaks if need be.

Questions and Answers

How far did your rocket travel? What changes did you make to your rocket? What was different about using the stomp rocket compared to using only the straw?
The answers may vary. Students will use different methods to measure their rockets, and make sure students use their data to show evidence for their explanation.

Try These Next

Moon Lander Anniversary Video Explainer TV:
https://www.youtube.com/watch?v=vJs840FocgY&t=37s

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