

Rocket Staging: Balloon Staging

Overview

Traveling into outer space takes enormous amounts of energy. This activity is a simple demonstration of rocket staging that Johann Schmidlap first proposed in the 16th century.

Purpose

Through participation in this demonstration, students will:

- Learn how rockets can achieve greater distances by using the technology of staging.

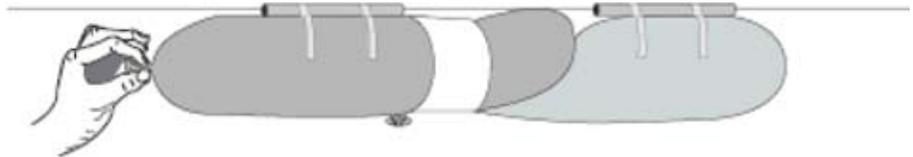
Preparation

- Gather all materials.

Materials

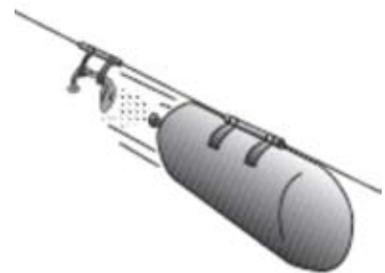
Per class:

- Student Data Sheets
(CD Location: Educator Resources/Guides/Student Guide)
- 2 long, party balloons
- Nylon monofilament fishing line (any weight)
- 2 plastic straws (milkshake size)
- Styrofoam coffee cup
- Masking tape
- Scissors
- 2 spring clothespins



Procedure

1. Thread the fishing line through the two straws. Stretch the fishing line snugly across a room and secure its ends. Make sure the line is just high enough for people to pass safely underneath.
2. Cut the coffee cup in half so that the lip of the cup forms a continuous ring.
3. Stretch the balloons by preinflating them. Inflate the first balloon about three-fourths full of air and squeeze its nozzle tight. Pull the nozzle through the ring. Twist the nozzle and hold it shut with a spring clothespin. Inflate the second balloon. While doing so, make sure the front end of the second balloon extends through the ring a short distance. As the second balloon inflates, it will press against the nozzle of the first balloon and take over the clip's job of holding it shut. It may take a bit of practice to achieve this. Clip the nozzle of the second balloon shut also.
4. Take the balloons to one end of the fishing line and tape each balloon to a straw with masking tape. The balloons should point parallel to the fishing line.
5. Remove the clip from the first balloon and untwist the nozzle. Remove the nozzle from the second balloon as well, but continue holding it shut with your fingers.
6. If you wish, conduct a rocket countdown as you release the balloon you are holding. The escaping gas will propel both balloons along the fishing line. When the first balloon released runs out of air, it will release the other balloon to continue the trip.
7. Distribute design sheets and ask students to design and describe their own multistage rocket.
8. Collect and display student designs for multistage rockets. Ask each student to explain his/her rocket to the class.



Questions

1. Can a two-stage balloon fly without the fishing line as a guide? How might the balloons be modified to make this possible?
2. How might other launch arrangements such as side-by-side balloons and three stages work?

Answer Key/What is happening?

When a lower stage has exhausted its load of propellants, the entire stage drops away, making the upper stages more efficient in reaching higher altitudes. In the typical rocket, the stages are mounted one on top of the other. The lowest stage is the largest and heaviest. In the Space Shuttle, the stages attach side by side. The solid rocket boosters attach to the side of the external tank. Also attached to the external tank is the Shuttle orbiter. When exhausted, the solid rocket boosters jettison. Later, the orbiter discards the external tank as well.

*Source: Rockets: An Educator's Guide with Activities in Science, Mathematics, and Technology
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