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— Balloon Rocket —

Suggested Grade Level: 3rd; can be modified for older students

NC Standard: 3.P.1

Lesson: Forces and Motion & Newton's Laws of Motion

Words and Phrases to Discuss: Demonstrates the basic principles of rocketry by applying the concept of pressure and Newton's Second and Third Laws of Motion. The lesson can be extended to introduce the concepts of drag and power. Force, Thrust, Pressure.



Materials List:

- Balloons
- Straws
- String (longer string required for larger balloons)
- Marker
- Cargo (paper clips, bottle caps, candy, etc.)
- Paper to make a cargo container
- Tape, glue and scissors

Instructions: Ask the students to break into small groups. Ask the class if they think they can make a simple rocket from a balloon that will propel itself down a string to exhibit Newton's Laws of Motion; demonstrating thrust generated by pressure. To set the lesson up, show photographs of rockets or videos of rockets launching.



Activity: Break the classroom into small groups and explain that they are going to construct a balloon rocket and take it for a few test runs. Ask the students to tie their length of string to a chair or other support. Have them place the loose end of the string through their straw. Have one student per group blow up the balloon and pinch it closed—do not tie the balloons! Take the balloon to the straw so that the opening is horizontal to the ground. This step will require two students working together. Have one student hold the loose end of the string pulling the balloon to the “starting line.” Let go of the balloon and watch it move along the string—marking where it stopped with a marker. Have students test different cargo across the string to the finish line. Students may also want to time their “runs” as another measurement. Observe the changes as other variables are introduced.

Science Notebook Helper: Have students record their findings as they conduct their test runs using variables—size of balloon, weight of cargo, inflation of balloons

Tips and Talking Points: Rocketry has existed for hundreds of years and while technology has changed, the basic principles remain the same. To propel a rocket, some kind of force must be expelled to push it forward. A force is the amount of push or pull on an object. The force that pushes a rocket through the air is known as thrust. Two of Newton’s laws relate to thrust—the Second Law of Motion is $F=ma$ (Force is equal to the mass of an object multiplied by its rate of acceleration.) The Third Law of Motion states that for every action there is an equal and opposite reaction. In this lesson, the rocket is propelled by pressure—the number of oxygen molecules that are blown into the balloon as compared to the air pressure outside of the balloon. The inside pressure acts as the fuel for the balloon. When the air escapes from the balloon, it pushes against the outside air which also pushes back. The rocket is propelled forward by the opposing force—thrust.

Guiding Questions

- As the amount of air you blew into the balloon increased/decreased, what impact occurred in the distance your rocket travelled?
- What happened when the opening of the balloon was released and the gas was allowed to escape? What causes this to happen?
- How long did it take for each object?
- What makes the balloon move faster?
- What happened when you added cargo?