

**Title:** Balloon Rockets

**Grade Ranges:**

    K-4  
  X  5-8  
    9-12

**Subject Tag:**

Science: Physics

**Synopsis:**

This activity demonstrates the principle of Newton's third law of motion, which states that whenever one object exerts a force on a second object, the second object exerts a reaction force of equal magnitude but opposite the direction of the first object (Action/Reaction). Working in two-person teams, students will make balloon rockets and experiment with variations of the model, chart the results, and form conclusions. They will relate their findings to the operation of real rockets.

**Keywords:**

Newton's third law of motion, rockets, rocket models, trajectory, friction, gravity, action/reaction theory, Newton's law

**Body:**

1. Discuss Newton's third law of motion with the whole class. Tell students that this law, which enables rockets such as space shuttles to leave the surface of the earth, can be demonstrated with a simple model. Show the class pictures or a model of one of the shuttles and explain how it works in terms of Newton's law.
2. Divide the class into teams of two. Each team needs two one-inch pieces of a drinking straw, a long balloon, nylon fishing line long enough to span a given space in the room, masking tape, pencil, and paper.
3. Each team should string the line through the straw pieces and attach the line to two fixed points in the room so that the line does not sag.
4. Next, students inflate their balloons and clamp the open end closed with their fingers, while the partners tape the balloon to the two straws. The straws should be about one inch from either end of the balloon.
5. Position the balloon at one end of the line, and release the open end. Use a metric stick to measure how far the balloon went. Record the distance on a data sheet.
6. Repeat step four, this time recording the time it takes for the balloon to come to a complete stop. Count one-one-thousand, two-one-thousand, etc.
7. Experiment with varying amounts of air in the balloon and record how distance and speed are affected.
8. Return to whole class discussion and share results.
9. Students should conclude that the escaping air relieves pressure at the neck, (action) and the air pushing against the inside of the opposite end of the balloon (reaction) propels it forward. It is NOT the air rushing out of the balloon and pushing against the outside air that drives the balloon.

**Objective:**

By completing this lesson students will review Newton's third law of motion, create a simple model to demonstrate this law, and relate it to real rockets such as the space shuttles.

**Standards:**

**NY: 1.1** Scientific Inquiry: The central purpose of scientific inquiry is to develop explanations of natural phenomena in a continuing, creative process. **4.5** Physical Setting: Energy and matter interact through forces that result in changes in motion. **6.2** Models: Models are simplified representations of objects, structures, or systems used in analysis, explanation, interpretation, or design.

**NYC: S1b.** Motions and forces, such as inertia and the net effects of balanced and unbalanced forces. **S5c.** Uses evidence from reliable sources to develop descriptions, explanations, and models. **S5f.** Works individually and in teams to collect and share information and ideas.

**CT: 13.** Interaction of Matter and Energy: Students will know that interactions between matter and energy can produce changes in a system, although the total quantities of matter and energy are unchanged. **14.** Science and Technology: Students will understand the relationships among mathematics, science and technology, and the way they affect and are affected by society.

**NJ: 5.2:** All students will develop problem-solving, decision-making, and inquiry skills, reflected by formulating usable questions and hypotheses, planning experiments, conducting systematic observations, interpreting and analyzing data, drawing conclusions, and communicating results. **5.4:** All students will develop an understanding of technology as an application of scientific principles. **5.9:** All students will gain an understanding of natural laws as they apply to motion, forces, and energy transformations.

**Time Required:**

One 45-minute class

**Technology and Materials Needed:**

1. Long Balloons
2. Nylon fishing line
3. Tape
4. Plastic straws