

# Balloon Rocket Blast Off

## Introduction

Have you ever watched a rocket or space shuttle soaring through the sky? How is it possible for these massive objects to move through the air? The basic principle behind rocket flight is Newton's third law of motion. In this activity, students will experiment with Newton's third law by launching balloon rockets across the classroom.

## Concepts

- Newton's third law of motion
- Rocket engine thrust

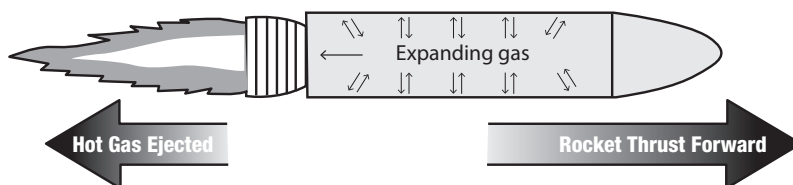


Figure 1.

## Background

Newton's third law of motion states that for every action force there is an equal and opposite reaction force. Rockets clearly demonstrate this law. As rocket fuel burns, a great amount of heat is created and the gas pressure inside the rocket engine increases. At the same time, the walls of the combustion chamber push back on the fast-moving gas particles. Rockets are composed of strong, solid materials with a small opening at the bottom. This opening is the only region on the engine where the pressure can be released. Since gas particles move from high to low pressure, the gas shoots out the bottom of the rocket. This results in a net force that thrusts the rocket in the opposite direction of the ejected gases (see Figure 1).

Newton's third law also explains how a balloon rocket works. When you blow up a balloon, the pressure inside the balloon increases and the walls of the balloon push against the air molecules. When the balloon is released, the air is forced out the "nozzle"—the mouth of the balloon. The result is a net force that propels the balloon in the opposite direction (see Figure 2).

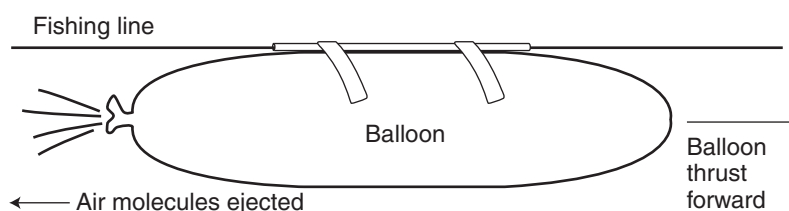


Figure 2.

## Materials

- |  |                   |
|--|-------------------|
| Balloons, thin and long, 2–3                               | Scissors          |
| Clothespin or paper clip (to temporarily seal the balloon) | Straw, drinking   |
| Fishing line, classroom-length (for rocket guidance)       | Support stands, 2 |
| Ruler, cm  | Tape, masking     |

## Safety Precautions

Use caution when launching balloon rockets. Be sure no one is in the path of a balloon before launching it. The fishing line may be difficult to see. Be aware of your surroundings as you walk through the classroom. Do not over-inflate the balloons and cause them to pop. Wear safety glasses. The latex (in balloons) may be an allergen for some individuals.

## Procedure

1. Unravel fishing line to extend the length of the classroom. Leave approximately one metre of fishing line slack and then cut the fishing line with scissors.
2. Tie one end of the fishing line to a support stand. Make sure the fishing line is secure and high enough to extend parallel to the floor across the classroom without interfering with objects in the room.
3. Obtain a drinking straw and use scissors to cut the straw to approximately eight centimeters.
4. Slide the drinking straw piece onto the fishing line.
5. Extend the fishing line to the opposite end of the classroom. Tie the end of the fishing line to another support stand so that the line is taut and parallel to the floor (see Figure 3).

## Balloon Rocket Blast Off *continued*

- Obtain a long, thin balloon. Carefully blow up the balloon to stretch it out, and then allow it to deflate.
- Place two 5-cm pieces of masking tape on the straw piece. Place the midpoint of the tape on the straw so that the tape ends extend equally from each side of the straw (see Figure 4).
- Inflate the balloon about  $\frac{3}{4}$ -full. Pinch the end of the balloon closed with fingers and twist it several times to seal the balloon, but do NOT tie a knot. Use a clothespin or paper clip to clamp the opening closed.
- Tape the inflated balloon to the straw, making sure the balloon is balanced, the straw is lined up along the fishing line and the straw is not crooked. Continue to pinch the opening closed with the clothespin or paper clip so no air can escape.
- Hold the balloon near a support stand and line up the balloon to “shoot” it straight down the fishing line.
- When the balloon is in position, remove the clothespin and release the balloon. Do not give the balloon any extra push.
- If the rocket does not travel all the way across the room, make necessary modifications and repeat steps 6–11. It is best to remove the original balloon and tape from the straw piece and use fresh tape and a new balloon each time.

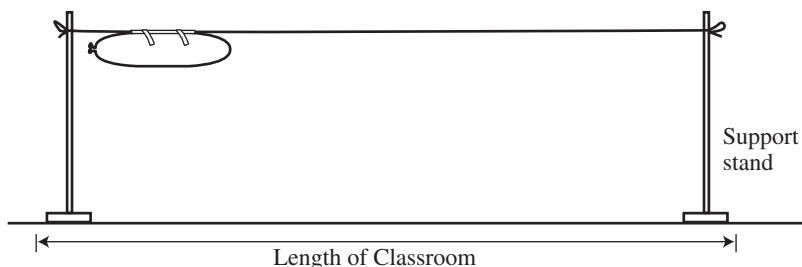


Figure 3.

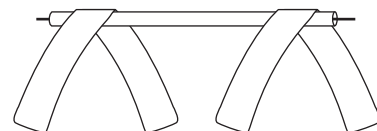


Figure 4.

## Disposal

All the materials may be thrown into the normal trash.

## Tips

- For further concept development and guided inquiry on this topic, try the Balloon Rockets—Guided-Inquiry Kit, available from Flinn Scientific Canada (Catalogue No. AP6927).
- The fishing line should be as taut as possible to prevent the balloon or straw from snagging the fishing line as the rocket flies across the room.
- Possible modifications to improve the range of balloon rockets include using thinner straws, such as coffee stirrers, as well as balloons of different size and shape.
- This lab activity, and concepts covered, can also be used as a great STEM Inquiry activity.

**Materials for *Balloon Rocket Blast Off—Student Laboratory Kit* are available from Flinn Scientific Canada Inc.**

Catalogue No.	Description
AP6927	Balloon Rockets—Guided-Inquiry Kit
AP6937	Balloons, Long, 5" × 24", Pkg. of 50
AP4550	Support Stand, Economy Choice

Consult [www.flinnsci.ca](http://www.flinnsci.ca) or your *Flinn Scientific Canada Catalogue/Reference Manual* for current prices.