**Balloon Blastoff**

**Purpose**

The purpose of this activity is to demonstrate how unbalanced forces produce motion. It will also demonstrate Newton’s Third Law, which states that, "For every action, there is an equal, but opposite reaction."

**Lesson Goal or Objectives**

By the end of the lesson, students will understand that when a balloon is blown up, the air inside pushes against the balloon and the balloon also pushes back against the air. When the end of the balloon is let go, the balloon is able to squeeze all that air out, but the air also pushes back against the balloon causing it to shoot across the string like a rocket.

This lesson addresses the misconception that air is not a force.

**Lesson Inquiry Question**

Does the amount of air in the balloon affect the speed and distance the balloon rocket travels?

**Target Group**

This activity is appropriate for students in third grade. To use with older students, the variables tested should be modified.

**Approximate Time**

Teacher prep: one hour to gather materials and create charts/graphs

Student: One class period or about 45 minutes

# Background Science Information

When you talk about motion, you need to have a **reference point**, or a designated position in space, in order to describe it. To measure motion, you need reference points. You can measure an object’s **displacement**, or the distance that it traveled from the reference point. You can also easily measure the time it takes for the object to travel that distance from the reference point. Using a reference point, you can also determine the direction of movement of the object.
 **Motion** then can be described as a displacement from an original position to a new position. **Speed** is the rate of movement over a distance. All motion is relative to the frame of reference. Sometimes our frame of reference is moving as well. **Force**, which is a push or pull on an object, may cause motion or alter motion.
 **Third Law of Motion**: Newton’s third law states that for every action there is an equal but opposite reaction. The air rushing out of a deflating balloon propels the balloon in the opposite direction. This same principle is used in all rocket motors to propel spacecraft. The impulse, which is a force applied for a very short period of time, acts on the balloon as it is deflating and is equal to and opposite the impulse from the exhaust. Air rushing out of a balloon causes it to travel in the opposite direction.

Peters, Joseph A. & Stout, David L. (2011). *Science in Elementary Education: Methods,
 Concepts, and Inquiries*. Boston, MA: Pearson/Allyn & Bacon.

# Background Information on Hearing Impairment

Persons with hearing impairments are categorized as either hard of hearing or deaf. Those who are hard of hearing still have a small degree of hearing, while deaf persons have no ability to hear. About .12% of students are identified as hearing impaired. Although there is no relationship between hearing disabilities and intelligence, students with hearing impairments show substantial academic deficits when compared to their hearing peers.

Hearing impairments are often labeled as one of the “invisible disabilities” because it is not apparent by visual observation. In addition to severe problems with language development and academic achievement, a hearing impairment often affects a student’s social and personality characteristics. As with other disability areas, positive social adjustment has much to do with how others accept the disability. A teacher who models a cheerful, positive, accepting individual with high expectations can greatly influence the socialization of the student with a hearing impairment. The classroom teacher must reflect confidence in the competence of the student in all aspect of performance: physically, academically, emotionally, and socially.

Today about two-thirds of hearing impaired students are taught by total communication, in which the use of sign language is paired with oral techniques.

Stefanich, G.P. (Ed.) (2001) *Science Teaching in Inclusive Classrooms: Models and Applications*. Cedar Falls, IA: Woolverton.

**Discipline-based Content Expectations**

**P.FM.03.36** Relate a change in motion of an object to the force that caused the change of motion.

**Inquiry Process:**

**S.IP.03.11** Make purposeful observation of the natural world using the appropriate senses.

**Inquiry Analysis and Communication:**

**S.IA.03.13** Communicate and present findings of observations and investigations.

**Reflection and Social Implications:**

**S.RS.03.11** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

**Materials Needed (per group)**

* 1 balloon (round ones will work, but the longer "airship" balloons work best)
* 1 long piece of kite string (about 10-15 feet long)
* 1 plastic straw
* tape

**Safety Considerations**

The string should be precut by the teacher, but if students need to shorten the string or the straw, students must be careful with scissor so they don’t cut themselves.

**References**

Michigan Department of Education (MDE) (2000). *Michigan Curriculum Framework Science Benchmarks.* Lansing: Author.

Peters, Joseph A. & Stout, David L. (2011). *Science in Elementary Education: Methods,
 Concepts, and Inquiries*. Boston, MA: Pearson/Allyn & Bacon.

Stefanich, G.P. (Ed.) (2001) *Science Teaching in Inclusive Classrooms: Models and
 Applications*. Cedar Falls, IA: Woolverton.

**PROCEDURE**

*Provide an outline of the lesson to the hearing-impaired student in advance and give your expectations.*

**Pre-Assessment:** Have students fill out the “What do we THINK we know” section of the balloon rockets chart.

**Description of Student Learning Activities**

1. **Engage:** Blow up a balloon and let it go flying through the air. This will grab the students’ attention. *Make sure the hearing-impaired student is paying attention before you release the balloon. Tap his/her shoulder before you begin.*
2. **Explore:** Ask the question, "What happens when you let go of the balloon filled with air?” *Speak clearly and make sure you are facing the class while speaking so the hearing-impaired student can read your lips.*
3. Give each group a balloon, a straw, string and some tape. Let the students get familiar with the materials and generate questions.
4. Perform a trial run. *In addition to verbal directions, provided printed directions. Use an overhead projector to show step-by-step instructions.*
	1. Tie one end of the string to a chair, door knob, or other support.
	2. Put the other end of the string through the straw.
	3. Pull the string tight and tie it to another support in the room.
	4. Blow up the balloon (but don't tie it.) Pinch the end of the balloon and tape the balloon to the straw as shown above. You're ready for launch.
	5. Let go and watch the rocket fly!
5. Perform the demonstration. *Observe the hearing-impaired student to insure he/she is engaged and participating.*
6. **Explain:** Provide reference material on force and motion for students to do research. Have students develop content and vocabulary. Students will research Newton’s Laws of Motion, specifically Newton’s Third Law. They will also research vocabulary terms such as force, motion, displacement, and speed. *If the hearing-impaired student uses an interpreter, work on an arrangement where the student can see both you and the interpreter. If the hearing-impaired student does not use an interpreter, ask for a notetaker. A student cannot speechread and take notes at the same time.*
7. Discuss: What happened when you let go of the balloon? Why did this happen? How does this relate to Newton’s Third Law of Motion? *When appropriate, repeat the questions and comments of others in the room.*
8. **Expand or Elaborate:** Together, develop a simple investigation to find out if the amount of air in the balloon affects how far the rocket will travel. Write the question on the board: “Does the amount of air in the balloon affect how far (or fast) the rocket travels?” *Make chalkboard notes legible. Do not talk while writing on the board.*
9. Create a list of materials for each group, i.e. balloon, straw, string, tape.
10. Students fill out the “HOW will we find out” section of the chart.
11. Create a procedure. (It would be advisable to do this together as a class.) *Speak clearly and make sure you are facing the class while speaking so the hearing-impaired student can read your lips.*
12. Have students test the variable. Vary the amount of air in the balloon and repeat the experiment three times.
13. Have students record their results and draw a picture of what occurred in their activity.
Label all parts of the diagram, carefully detailing what happened. *In addition to verbal directions, provided printed directions.*
14. Analyze the data they have collected. What surprised you? What can you say about force and motion? What is our conclusion? Students may be surprised that the balloons with the most air traveled the fastest and farthest. Some students might think the smaller the balloon, the less it weights, the farther it will travel.

**Post-Assessment:** Have students complete the “What do we CONCLUDE” section of the chart. Together as a class, compare answers and discuss.

|  |  |  |
| --- | --- | --- |
| **What do we THINK we know about BALLOON ROCKETS?** | **HOW will we find out?** | **What do we CONCLUDE?** |
|  |  |  |

**Post-Assessment Rubric:**

|  |  |  |
| --- | --- | --- |
| Student does not complete the chart. Vocabulary is incorrect. | Chart is partially filled out. Information is not completely correct. | Chart is completely filled out. Information is correct. |
| 0 Points | 5 Points | 10 Points |

**Real-World Connections**

Ask the students to think of what other things in the world around them might also act in the same way? Since these are balloon “rockets”, have students consider real rocket ships. Do they act in the same way?

What other real-world connections apply to Newton’s third law? Give them a few examples to get their minds in gear. Suggest things like rowing a boat, shooting a bow and arrow, or pinching a chip clip to open it up.

|  |  |  |  |
| --- | --- | --- | --- |
| **TRIAL** | **DISTANCE (m)** | **TIME (sec)** | **SPEED (m/sec)** |
| **1** |  |  |  |
| **2** |  |  |  |
| **3** |  |  |  |
| **AVERAGE** |  |  |  |

Balloon Rockets

|  |  |  |
| --- | --- | --- |
| What do we **THINK**we know about balloon rockets? | **HOW** will we find out? | What do we**CONCLUDE?** |
|  |  |  |