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Balloon Rocket Cars

A **force** is a push or a pull that acts upon an object as a result of its interaction with another object. In other words, forces result from interactions! According to Sir Isaac Newton, whenever two objects interact with each other, they exert forces upon each other.

For example, even as you're sitting calmly in your chair, there are two forces interacting: your body exerts a downward force on the chair, and the chair exerts an upward force on your body.

These two forces, known as **action and reaction forces**, are the subject of Newton's Third Law of Motion:

For every action, there is an equal and opposite reaction.

Objective:

Students will build balloon-powered rocket cars that demonstrate Newton's Third Law of Motion.

Materials:

For each rocket car, you will need:

- 1 sheet of cardboard
- 1 balloon
- 3 straws
- 2 wooden dowels (i.e. skewers)
- 4 wheels (with holes)
- 9 rubber bands
- strips of clear tape
- glue

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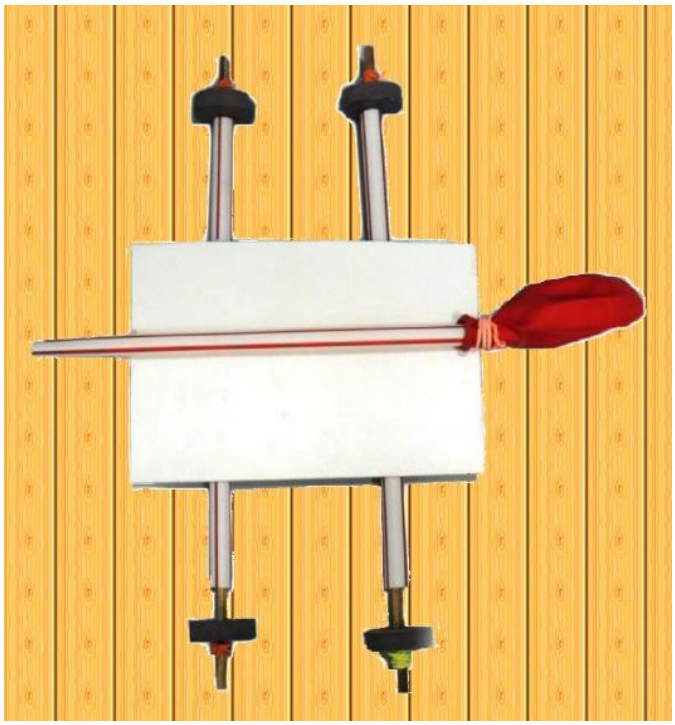
All the materials should be easy to find at a craft or dollar store. It doesn't matter if the wheels are wooden, plastic, or rubber, as long as they have a hole in the center (preferably of 0.25" or less). If you can't find wheels locally, we recommend searching for "toy wheels" online at eBay or Amazon. You should be able to find a pack of 20-50 wheels at a reasonable price.

NOTE:

Make sure that the wooden dowels are longer than the plastic straws.

If you use wooden skewers, you may want to trim off the pointed edges for safety.

Procedure:



1. Insert a wooden dowel into a straw. Ensure that the dowel is longer than the straw.
2. Attach a rubber band securely around the wooden dowel at the point where it meets the straw.
3. Place a wheel on the dowel so that it is pressed up against the rubber band. The wheel must fit snugly. You may want to attach it with glue.
4. Attach a second rubber band securely around the wooden dowel. Slide it into place snugly against the wheel. Again, use glue as needed.
5. Follow steps 2-4 for the other side of the same wooden dowel. You now have one axle and set of wheels.
6. Follow steps 1-5 for a second axle and set of wheels.
7. Using tape, attach each axle-and-wheel assembly onto the cardboard, as show above.
8. Use a rubber band to attach an uninflated balloon to another straw. See diagram above.
9. Flip the cardboard over and tape the straw with balloon across the opposite side of the cardboard, as shown above.
10. Inflate the balloon by blowing into the straw, then quickly press a finger over the end of the straw to hold the air inside the balloon until you're ready to launch.
11. Place your balloon car on a flat surface and let go!

Try this!

Experiment with different shapes of cardboards—triangles, ovals, etc.

- Does the shape of the car make any difference in its speed?
- What happens if you use thicker (or thinner) cardboard?

Attach pennies or other small weights to the cardboard and see what changes occur.

- Does the speed or distance of the balloon rocket car change with additional weight?
- How much weight can you add before the car doesn't move at all?

Questions:

When you release the balloon, in what direction did the balloon rocket car go?

How far (in measured distance) did the car travel?

How long (in measured time) did the car remain in motion?

What do you think caused the sound you heard as your rocket car moved along?

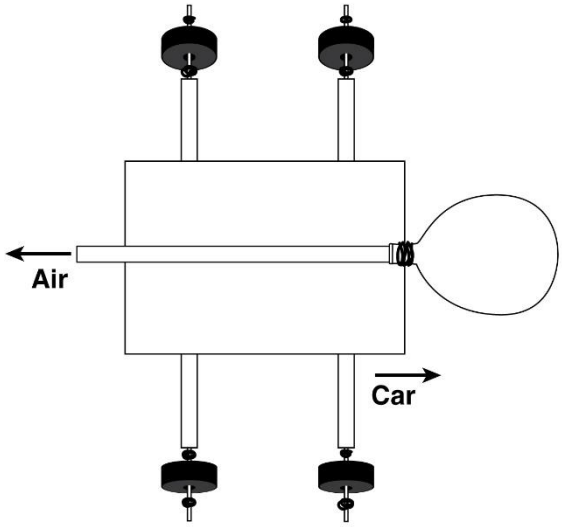
Was an action force taking place during your experiment? What object caused it?

Was a reaction force taking place during your experiment? What object caused it?

How does the amount of air in the balloon affect the distance your rocket car travels?

How it works:

As the air rushes out of the balloon in one direction, it pushes the car in the opposite direction.



Adapted with permission from
http://www.teacherstryscience.org/gu/lp/balloon-powered-toy-car.

Take Your Lesson Further

As science teachers ourselves, we know how much effort goes into preparing lessons. For us, "*Teachers Serving Teachers*" isn't just a slogan—it's our promise to you!

Please visit our website for more lesson ideas:

TeacherSource.com/lessons

Check our blog for classroom-tested teaching plans on dozens of topics:

http://blog.TeacherSource.com

To extend your lesson, consider these Educational Innovations products:

3-2-1 Blast Off! Kit (PHY-321)
Our 3-2-1 Blast Off! workshop on forces and energy has become a standing-room-only event at NSTA conferences. Over the years, teachers have asked us to develop a kit that bundles our much-loved demonstrations of things that go 'bump' in the day! Kit includes comprehensive teaching instructions and enough hands-on components for up to 10 students. Safety glasses recommended.

Rocket Balloons (RKT-135)
A great way to demonstrate basic principles of Newton's Laws to students. In order for a rocket to be stable the center of gravity must be forward of the center of pressure. Balloons are inherently unstable which is why they swirl around in every direction when you allow the air to escape. Rocket balloons are properly weighted to create stability.

Wooden Car Kit (WK-1)

A great way to demonstrate basic principles of Newton's Laws to students. In order for a rocket to be stable the center of gravity must be forward of the center of pressure. Balloons are inherently unstable which is why they swirl around in every direction when you allow the air to escape. Rocket balloons are properly weighted to create stability.

Reaction Rocket (RKT-625)
This rubber ball launcher and plastic rocket may look simple, but they're a sure-fire way to provoke a WOW reaction—and introduce students to Newton's Laws. Hold the top of the launcher and drop it straight down onto a hard surface. The rocket shoots up dramatically higher than its original drop height. Explaining energy conversion was never this easy...or this much fun!

Articulating Stomp Rockets (RKT-210)

Your students will have a blast building their own rockets and taking our articulating launching pad outside for hands-on experiments related to Newton's laws, energy transfer, aerodynamics, and more variables than we can name! Includes 10 distance marker flags, a protractor, step-by-step assembly instructions, a rocket template, teaching lessons, and student worksheets. Can be modified for use in K-12 classes.