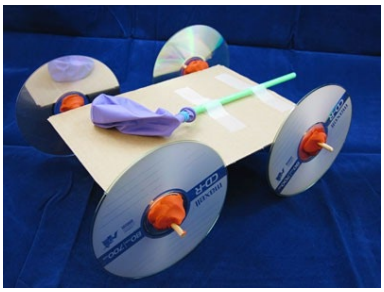
3rd – 6th

Balloon Rover

E-Week Challenge 2023



Program Description

Students will design and build a rover out of simple materials. The goal is to build a rover that can travel at least 3 feet in a straight line.

Background & Task

Engineers at NASA are exploring alternative methods of powering vehicles on other planets. One idea that they consider is using a air to store potential energy to be used by the vehicle in a controlled way. NASA engineers need you to create a model for a vehicle that can store energy and release it to bring the rover to rest as close to a target location as possible. To best model their material, NASA Engineers have provided you with a bundle of balloons to use as power sources. You may use the balloons in any way you would like, but you can use no more than 2 balloons as sources of power. Only balloons can power your rover.

Time

45 minutes

Activities

- **Introduction:** Learn mission goals and requirements.
- **Activity 1:** *Plan It* - Students will collaborate to create design ideas for their rover
- **Activity 2**: *Build It* - Students will choose materials to construct their designs
- **Activity 3:** *Test It* – Students will test their designs to see if it is successful
- **Analysis and Reflection Questions**: Students will evaluate their designs and form conclusions based on their findings

Materials

- Balloon (1)
- Cardboard (1)
- Pencils (2)
- Construction paper (10 sheets)
- Tape (1 roll)
- CD's (4)
- Paper clips (6)
- Scissors (1)
- Jumbo straw (2)
- Small piece of modeling dough (1 per group)
- Miscellaneous crafting supplies
- Source Material
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INTRODUCTION

Divide class into teams of no more than 5 if possible. Groups will have 5 minutes for an introduction to the challenge and 30 minutes to make Rubber Band Rover. Any additional time will be spent on testing and analysis. Students can build their rovers however they'd like, but they must use the assigned materials – no extras.

ACTIVITY 1: ***Plan It (recommended 5-7 minutes)***

Now that you have received your challenge take some time to examine the supplies that you can work with. Using your blank paper, sketch some ideas for your team's rover and then share with your group. Collaborating with your teams on your designs is a great way to make sure that everything works together and is designed as effectively as possible.

ACTIVITY 2: ***Build It (15 minutes)***

After reviewing the ideas of teammates, the group should decide on a design and begin construction. Work quickly, stopping as needed to fix parts that don't work as expected.

ACTIVITY 3: ***Test It (10 minutes)***

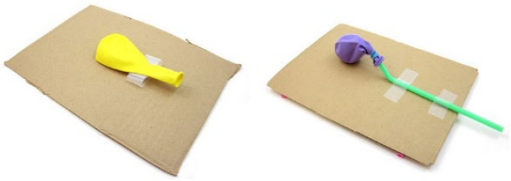
Even the best laid plans can have a few hiccups when it comes to completion. You should test your vehicle a few times before trying to hit the target.

When time is up, take turns lining up at the start point to get as close to the target as possible. Each team should get at least 2 tries.

Building Guide (optional)

- The body of the car (piece of cardboard or plastic bottle in Figure 1)
- The wheels of the car (CDs or plastic bottle caps in Figure 1)
- The axles, which connect the wheels to the body, and allow the wheels to spin

1. Many balloon-powered car designs attach the neck of the balloon to a "bendy" straw using a rubber band. This makes it easier to attach the balloon to your car, to inflate the balloon, and to aim the direction of the air escaping the balloon.



2. Most balloon cars work better if the axles can rotate freely. If you insert a pencil or skewer through a drinking straw will allow it to rotate and serve as an axle.

3. Wheels usually work better if they are centered on the axles and do not wobble. Depending on what you use for wheels and axles, you will need to come up with a way to securely attach them.

4. Inflate the balloon (by blowing through the straw, if you attached it to a straw).
5. Pinch the end of the balloon shut or put your finger over the end of the straw, to prevent air from escaping.
6. Put your car down on the floor and let go of the balloon.

Troubleshooting

If your car didn't move, it's time for some troubleshooting.

- If your car does not work at all (it does not move forward even a little bit, or it falls apart), try to figure out what is wrong. Are the wheels stuck? Is the car too heavy for the balloon to push? Do you need to use more tape to hold things together?
- If your car works, but not very well (it only moves forward a little, or it moves but turns to one side instead of going straight), try to figure out how you could improve it. Are the wheels or axles crooked, causing the car to turn? Are the wheels getting slightly stuck, preventing the car from going fast?
- Even if your car works well, think about what changes you could make to improve it. Can you modify your car to make it go even farther? What happens if you try to inflate the balloon even more?

Analysis & Reflection Questions

1. How well did your rover work? What would have made it work better?
2. Do you think that air was a good enough power source to move the rover? What sources could be better?
3. What would happen if we added more balloons?
4. How do Newton's Laws apply to the rover?