



Air Cannons

Boom! Boom! Boom! Explore the physics behind air pressure to engineer a cannon. Create a vortex of air to see how far you can launch your pom-pom across the room!

TEKS:

SCI 3.5B: The student is expected to describe and classify samples of matter as solids, liquids, and gases, and demonstrate that solids have a definite shape and that liquids and gases take the shape of their container.

SCI 6.8B: The student is expected to identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

SCI 8.6A: The student is expected to demonstrate and calculate how unbalanced forces change the speed or direction of an object's motion.

Materials:

- Duct tape
- 16-ounce paper cup
- Pencil
- Plastic newspaper bag or plastic produce bag
- Pom-poms (small- and medium-sized)
- Scissors

How To:

1. Using the pencil, poke a hole in the bottom of the paper cup. Make sure your hole is in the center. Twist the pencil in the hole to smooth the edges of the hole.
2. Open the plastic bag and place it around the mouth of the paper cup.
3. Secure the plastic bag around the mouth of the paper cup with duct tape. The plastic bag should be airtight to the cup.
4. Check for any air leaks or holes in the bag by blowing into the hole you made in the bottom of the cup and feeling for escaping air. If you find any leaks, seal them with duct tape.
5. Blow into the hole in the bottom of the cup to inflate the plastic bag. Try to trap as much air as possible inside the air cannon.
6. Load the pom-pom into the hole in the bottom of the cup. The pom-pom is the ammo and acts like a plug for the air to stay in the cannon.

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7. To launch the pom-pom, firmly squeeze the bag. The air will rush out of the cannon and send the pom-pom flying!
8. Explore different techniques with the air cannon like changing how hard or fast the bag is squeezed, using different pom-pom sizes, or testing other objects as ammo.



STEM Explanation:

The air cannon can be explained by a combination of physics concepts! The pom-pom acts as a plug to keep air from leaking out of the cannon, but it is only a weak plug. When the bag is squeezed, the air pressure inside the cannon rapidly increases. The pressure eventually overpowers the seal and sends the pom-pom flying! The physics behind the moving air is called fluid dynamics. Air acts like a fluid when being moved from high pressure to low pressure. As the bag is squeezed, the air creates a vortex in order to rush out of the small hole in the cup, like a tornado or water going down a drain. Air is unique because its vortex makes a donut-shape, called a torus, as it passes through the small hole in the cup. The torus shape forms because the air bursting out of the hole displaces the surrounding air and continuously moves the air from the center to the edge of the donut shape. This occurs because air pressure is greater in the center of the donut, which means the air in the middle is moving faster than the air at the edges. This helps the torus hold its shape and travel far distances. If air with color is used to create an air cannon, the torus can be seen! Try filling the air cannon from a fog machine or lining the cup with flour. When you squeeze the bag, rings of vortexed air will come swirling out of the cannon! Explore other objects you have around the house, like a paint bucket or trash can, to create an even larger air cannon!

Career Connection:

Physicists are scientists who do research in physics, which involves the study of matter and its motion through space and time, along with related concepts such as energy and force. More broadly, it is the general analysis of nature conducted to understand how the universe behaves.

Resources:

<http://pbskids.org/designsquad/build/air-cannon/>

<http://www.physicscentral.com/experiment/physicsathome/cannon.cfm>

<https://www.scienceworld.ca/resources/activities/air-cannon>

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