



MAKE YOUR OWN GALILEAN CANNON

BIG IDEA

Use the law of conservation of energy to make your own “Galilean Cannon”

SET IT UP

You'll need:

- Large open space
- Basketball
- Tennis ball
- Other balls of varying sizes

Before Building the Cannon

Experiment by dropping a basketball from different heights.

What do you notice?

- Does the ball ever go higher than where you release it?
- Does the tennis ball do the same thing?

What's Going On?

When you lift up a ball, you're giving it potential energy – the force of gravity will pull it back towards Earth, so we call this “gravitational potential energy.” Energy cannot ever be created or destroyed – but it can be transformed. As the ball falls downwards, the potential energy changes into kinetic (or moving) energy. When the ball hits the ground and bounces back up, that kinetic energy changes back into potential energy. Of course, the ball bounces a little bit lower every time because some of the energy is lost to friction, sound, and heat as the ball changes shape when it hits the ground.

Adding Energy

How can you make the ball bounce higher than where you release it?

One way is to throw the ball downwards. When you do this, you're giving the ball some extra kinetic energy at the beginning of its motion, which will result in a higher bounce with more gravitational potential energy.

Making the Cannon

Another way to make a ball bounce higher is to create a collision between two or more balls and transfer energy from one ball to another.

What happens when you hold the tennis ball on top of the basketball and drop them?

Try it again. What happens to the tennis ball? How about the basketball?



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What's Going On?

You just launched the tennis ball into the air using a Galilean Cannon!

When the basketball hits the ground, it starts bouncing up into the air, but there's a tennis ball in the way. This creates something called an "elastic collision" and energy from the basketball is transferred to the tennis ball.

This means that the tennis ball bounces upwards with its own energy plus some extra energy from the basketball, allowing it to bounce way higher than it normally would.

If you look carefully, you'll also notice that because the basketball transfers some of its energy to the tennis ball, it bounces lower than normal. And since the basketball is heavier than the tennis ball, the same amount of energy can launch the tennis ball much higher.

Experiment

Try dropping the balls with different set ups. Move them around each other, but make sure they're still touching one another when you drop them. What happens?

If you have other balls of different sizes, try adding a third ball. Stacking the balls from largest (on the bottom) to smallest (on top) will give you the best results.

Can you find an ideal combination of balls that transfers all of the kinetic energy to the top ball?

Setting a World Record

The NCSciFest team worked with members of the UNC Department of Physics and Astronomy to set the world record for the highest launch from a Galilean cannon. We used a stack of 4 rubber balls called the "Seismic Accelerator" to transfer all the energy into the smallest ball and designed a special device to help us maximize the results.

When we did this experiment, we were able to launch the ball over 13 meters – or 42 feet!

Do you think you can break that record? Try experimenting with your Galilean cannon at home and use #NCSciFest to share your results with us on social media!

Learn More

UNC Department of Physics and Astronomy – www.physics.unc.edu

Guinness World Record - www.guinnessworldrecords.com/world-records/428375-highest-launch-from-a-galilean-cannon

Seismic Accelerator - www.teachersource.com/product/astro-blaster-multiple-collision-accelerator

WITH THANKS AND FOR MORE INFORMATION, VISIT:

www.ncscifest.org

