



Project Exploration creates transformative learning opportunities for youth underrepresented in the sciences –particularly students of color and girls – by equipping them with the skills, practices, and mindset needed for a lifelong pursuit of learning. STEM@Home makes activities around science, technology, engineering, and math accessible and fun to do at home. This STEMbook activity, resources, and more are available at [www.projectexploration.org/stemathome](http://www.projectexploration.org/stemathome).

## In this activity, you will:

learn the physics behind Newton's cradle and create a model of Newton's cradle using popsicle sticks and marbles!



## Supplies Required:

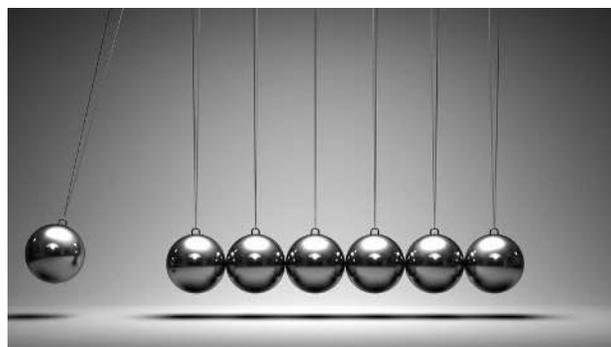
- Jumbo Craft Sticks
- Marbles
- String
- Scissors
- Glue
- Tape
- Pencil
- Hot Glue Gun/Super Glue (if we cant use I prefer Super Glue)

## Video

Learn about the physics behind Newton's cradle: <https://tinyurl.com/y543splz>

## Overview

Newton's cradle demonstrates the **conservation of momentum**, using a series of swinging balls or marbles. This principle states that when two objects collide, the total momentum of the objects before the collision is equal to the total momentum of the objects after the collision. That is, when one marble is lifted away from the others and dropped, the first marble collides and transfers the equal amount of momentum from its drop into the stationary marbles, causing the last marble on the opposite end to bounce outward. You witness this conservation of momentum as the last ball swings into the air with nearly the same momentum as the first ball. Thus, if two balls are lifted into the air on one end of the device and released, then two balls on the opposite end will swing in response.



## Instructions

1. Watch the instructions on Youtube or follow the printed instructions below: <https://tinyurl.com/y2u4k367>
2. Glue (4) craft sticks together at the corners to make a square. Repeat with (4) more crafts sticks. Let dry. These will be the sides of the frame.
3. Cut string into (6) equal pieces approximately 8" long
4. Hot glue a marble to the center of one of the pieces of string. Repeat to end up with (6) separate marbles, each glued to the center of a string.
5. Make (6) marks along two craft sticks every  $\frac{1}{2}$ ". Make sure the marks are centered on the sticks.
6. Tape one end of the strings with marbles attached along one of the craft sticks at each mark. Set aside.
7. Using hot glue, assemble the frame. Take the two sides and hot glue a craft stick perpendicular to each corner. The final frame will be a cube.
8. Glue the craft stick with the taped string/marbles to one side of the frame.
9. Glue the second marked craft stick to the opposite side of the frame.
10. Tape the loose end of each string with a marble attached to the marked craft stick. Pull on the strings gently to make sure the marbles align. The marbles must line up both horizontally and when viewed from the top.
11. Test your model! What happens when you lift and drop one marble into the others? With two? Describe what happens.

## Additional Resources

**Think about it!** What does Newton's cradle demonstrate? If the law is correct, the balls would transfer the momentum again and again equally and the balls would never stop swinging. Is this what happens? Why do you think this is? What other laws of physics may be at work here?

1. Newton's three laws of motion explained: <https://tinyurl.com/yy6nvevu>
2. Newton's laws demonstrated in space: <https://tinyurl.com/yy2djpbj>
3. Newton's laws in everyday life: <https://tinyurl.com/yctv79kf>

## Share It Out

After watching the third "think about it" video, can you think of other examples of the laws of motion that are in action everyday, all around us? Share a video of your Newton's cradle and describe what is happening. What laws are playing a role in your model?

**Share on social media:** Share your Newton's cradle model on social media using the hashtags:

#NewtonsLaws  
#DIYNewtonsCradle  
#ProjectExploration  
#STEMatHome

For more activities like this one, go to [www.projectexploration.org/stemhome](http://www.projectexploration.org/stemhome). If you're interested in learning more about Project Exploration and our free events, programs, and activities, please find us on social media and be sure to follow!



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