

How To Make A Newton's Cradle

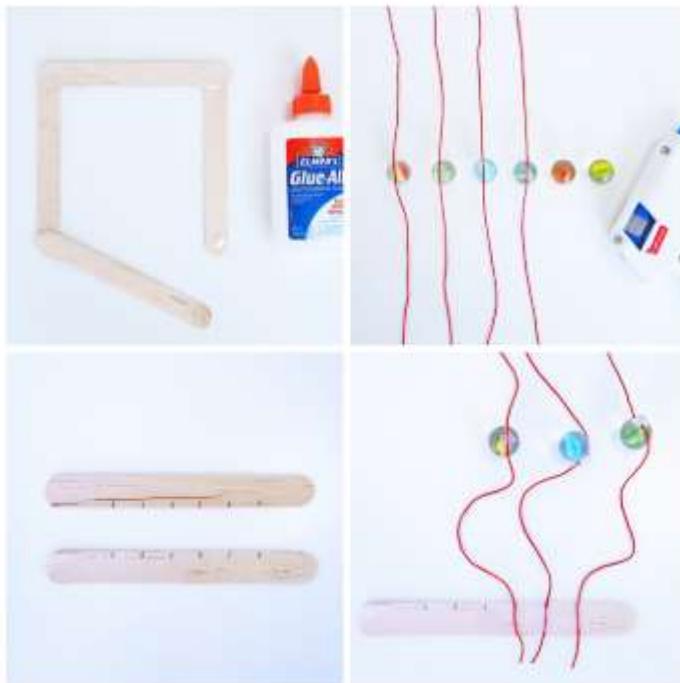


Materials

- **Jumbo Craft Sticks**
- **(6) Marbles**
- **String**
- **Scissors**
- **Glue**
- **Tape**
- **Pencil**
- **Hot Glue Gun/Glue**

Instructions

- **Step 1** 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.
- **Step 2** Cut string into (6) equal pieces approximately 8" long
- **Step 3** 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.
- **Step 4** Make (6) marks along two craft sticks every $\frac{1}{2}$ ". Make sure the marks are centered on the sticks.
- **Step 5** Tape one end of the strings with marbles attached along one of the craft sticks at each mark. Set aside.



Let's Talk STEAM

The Science

Newton's Cradle is a toy named after the very famous scientist, [Sir Isaac Newton](#). It demonstrates a scientific idea called momentum. **Momentum is the force of an object as it moves.** When you swing one of the marbles on

the end, it collides with the marble next to it and the force of that collision travels through each of the other marbles until it reaches the last one, which swings upward. When that marble swings back down, the force travels through the marbles again. [Read more about momentum and collisions here.](#)

This is a demonstration of a scientific principle called the **conservation of momentum**. This principle states that when two objects collide their momentum before the collision equals their momentum after the collision. In Newton's Cradle the force of the collision travels through each of the balls until it reaches the last ball which swings up.

Momentum is also directly related to the mass of an object: **Momentum = mass * velocity**

While developing this project I experimented with different products for the spheres. I had hoped that plastic beads would work since they would be much easier to use. The issue is that they have very little mass and therefore their momentum was not very strong when they swung. You need to use a material for the spheres that is dense and can actually transmit energy through it

Density is a measure of the amount of mass per unit of volume of an object. Denser objects have more mass. The more mass an object has, the stronger the force of momentum will be when it swings. You can test this out yourself as part of a science fair project! See our [How to Turn this into a Science Fair Project](#) section below.

The Engineering

This DIY toy is supported by a rigid frame. **A frame is a structure that holds something tightly in place.** This toy has a lot of movement in the marbles and will not work if the frame around the marbles also moves.

Newton's Cradle also demonstrates a concept called **tolerances**. In engineering, products must be built very precisely. If they aren't, the product will fall apart when in use. In Newton's Cradle the marbles must be hung very carefully side by side and in a line or the toy won't work.

More Ideas

Have fun playing with this! Try lifting and releasing two marbles at a time. What happens?

Color the craft sticks first and learn about capillary action! If you soak craft sticks in water colored with food coloring, the color will travel up through the wood as the water is absorbed. [You can learn how to do that here.](#) Let dry and then construct a tie-dyed Newton's Cradle.

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