



Curiosity Guide #606

Springs

Accompanies Curious Crew, Season 6, Episode 6 (#606)

Design a Jack-in-the-Box

STEM Challenge

Description

Design your own version of a fun toy that's been around for hundreds of years!

Materials

- Miscellaneous small boxes
- 12-gauge wire
- Rolling pin
- Old tube socks
- Bubble wrap
- Scrap fabric
- Tape
- Paper clips
- Needle nose pliers
- Bed springs
- Scissors

Procedure 1: Make the spring

- 1) Cut a ten-foot length of wire.
- 2) Wrap or coil the wire around a rolling pin or cylinder so that the spring has a diameter of about $2 \frac{1}{2}$ inches.
- 3) Cut the toe of the sock with a pair of scissors.
- 4) Slide the spring inside the tube sock and set aside.

Procedure2: Make the box

- 1) Select a box that can easily hold the spring when compressed.
- 2) Cut a cardboard top for the box so that there is an overhanging flap that comes over the front.
- 3) Use heavy tape or threaded wire loops to attach the box top on the side opposite of the flap.
- 4) Close the lid so the flap hangs down in the front.
- 5) Poke a small hole through the flap and front with a stiff, straightened paper clip.

Procedure 3: Assemble and test

- 1) Roll the sock up from the bottom to expose the base of the spring.
- 2) Tape the bottom of the coil spring into the bottom of the box.
- 3) Unroll the sock to cover the base of the spring.
- 4) Make a head for the Jack-in-the-Box.
- 5) Attach the head to the top of the spring with tape.
- 6) Compress the Jack-in-the-Box into the box, close the lid, and secure with the paper clip key.
- 7) Test the jack-in-the-box by pulling the paper clip out.

My Results

Explanation

The compression spring is the main part of the Jack-in-the-Box. Compression springs are usually made from heavy gauge material and are not wound as tightly as tension springs are. This allows the coils to compress closer together when a force acts on the spring. In this case, when the lid is held closed, the Jack-in-the-Box spring is compressed and holds a lot of elastic potential energy. When the pin is pulled, the spring extends, transfers the potential energy to kinetic energy, and moves the Jack-in-the-Box out the top of the box.

Learn more. Jack-in-the-Boxes were invented hundreds of years ago in Germany. The spring makes the toy such fun. Did you figure out that a squished compression spring held inside would allow the Jack to jump out when the door was opened? Traditional Jack-in-the-Boxes also have a handle that when cranked plucks different sound chimes to play the music. Then a rotating peg slides the door open at a certain moment in the music. Pop, goes the weasel!

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