

STEM in the lab

• Inspiring Idaho's future STEM workforce

EXPLODING CRAFT STICKS



GRADE LEVELS

This activity is appropriate for students in grades 3-5.



VOCABULARY

ATOM: a nucleus that is usually surrounded by one or more electrons.

CHAIN REACTION: a reaction that initiates its own repetition.

KINETIC ENERGY: the energy of motion, observable as the movement of an object, particle, or set of particles.

NUCLEAR FISSION: the process of splitting of a large atom into two or more smaller atoms.

POTENTIAL ENERGY: the energy that is stored in an object due to its position relative to some zero position.



MISSION

Use craft sticks to show how chain reactions work in nuclear fission.



MATERIALS

- » Craft sticks
- » At least 2 people

ABOUT THIS ACTIVITY

When an atom is split, a huge amount of energy is released. When the energy is released in a slow controlled manner, it can be used to generate electricity. Nuclear fission is the process of splitting of a large atom into two or more smaller atoms. At Idaho National Laboratory, nuclear scientists study, create and use nuclear fission to learn more about how to expand the use of nuclear energy.

In this activity, you will weave craft sticks together to demonstrate the chain reaction that occurs in nuclear fission. When the activity is complete, compare how the sticks hitting each other are similar to chain reactions that happen in nuclear fission.



DIRECTIONS

1 Find a hard, flat surface that can be used to stack craft sticks.

2 With two of the craft sticks, cross them to make an "x" shape on the hard, flat surface.

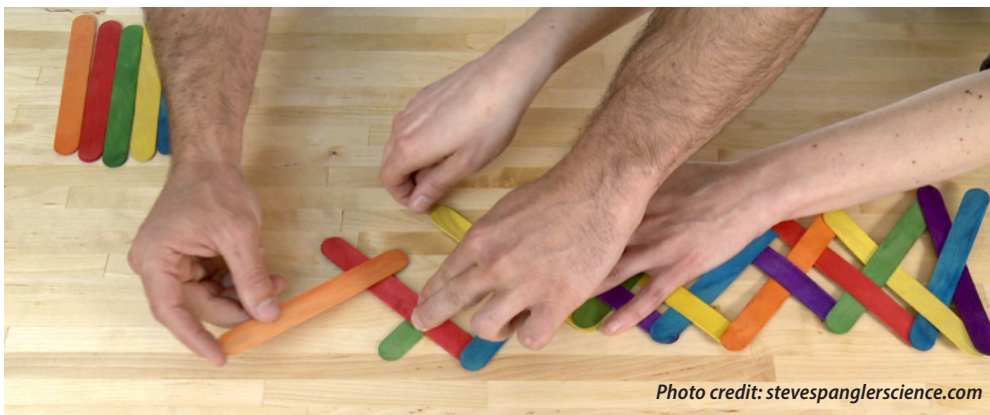
3 Place the END of a third craft stick UNDER the UPPER end of the craft stick on the bottom of the "x" shape. The third craft stick then goes OVER the craft stick on top of the "x" shape. As you are completing this step, make sure that one person applies pressure (or clamps) on the center of the "x" shape. You will be making a weave with the craft sticks.



4 Repeat step 3 with a fourth craft stick, but this time place it UNDER the open end of the bottom stick. When this step is completed the second and fourth stick are parallel to each other.

5 As each step is completed, potential energy is building. Make sure that one person is still applying pressure to the center of the "x".

6 The first "x" shape is locked into place. Continuing adding craft sticks by repeating steps 2-4, until you have about 10-15 in a chain.



7 Just remember it is OVER then UNDER, that holds all the sticks together and builds up energy.

8 When your chain is complete, let go of the unclamped end. The craft sticks will turn potential energy into kinetic energy and create an awesome chain reaction.

9 The key to the craft stick chain-reaction comes from potential energy in the over/under weaving and kinetic energy in the release. As you weave the craft sticks together, you're gradually and continually building potential energy in the craft sticks. Each craft stick is slightly bent over a stick on one end and held under a stick on the other. This twisting and bending in the wood fibers is not a normal position. The sticks want to return to a normal position and lose the added energy, but they can't because weight is being applied on the center of the "x".

10 Try building different lengths of chains. How are the reactions different?

THE SCIENCE BEHIND IT

The fission of U-235 (uranium) splits off two neutrons, which in turn strike two more U-235 atoms. Two neutrons are split from each of the two U-235 atoms. Each of these neutrons then go on to strike another U-235 atom. Each of those atoms are split releasing two neutrons, which go on and hit more uranium atoms. The chain reaction continues on and on, getting bigger and bigger with each split. The bigger the chain reaction, the more energy that is created.



FURTHER EXPLORATIONS

- » Create a chain reaction using dominoes.
 1. Stand dominoes up on their short end and arrange them in any pattern on a flat surface.
 2. Knock over a single domino. What happens to the other dominos?
 3. Try different patterns. Knock over one domino – what happens to the others?
 4. After you've tried multiple patterns, arrange them in a single line. Now what happens to the dominoes?
- » What objects work best to stop a chain reaction? In a nuclear reactor, control rods are used to slow down the reaction. A control rod is made up of cadmium or boron. These elements absorb neutrons. If you insert the control rod between the uranium atoms, the amount of neutrons available to cause more splits is reduced, breaking the chain reaction. Try using a ruler and place it between the dominoes to slow down the reaction.
- » Go bowling. How does the setup of the bowling pins cause the most effective chain reaction? What happens to the chain reaction when the center pin is knocked down?

RESOURCES

- » **Popsicle Stick Chain Reaction Activity**
<https://www.stevespanglerscience.com/lab/experiments/popsicle-stick-chain-reaction/>
- » **INL Resource Library**
<https://inl.gov/inl-initiatives/partnering-with-inl/k-12-stem/resource-library/>
- » **Physics for Kids: Nuclear Energy and Fission**
https://www.ducksters.com/science/physics/nuclear_energy_and_fission.php

LEARN MORE

Students + Parents + Educators

For information on grants, training and student opportunities, curriculum ideas, and other resources, please visit **stem.inl.gov**.