



# Cupid's Arrow Math Game

Ready, aim, fire! Who can score the most points with Cupid's mini bow and arrow? Watch potential energy turn into kinetic energy as your arrow launches across the room!

## TEKS:

SCI 4.6 D: The student is expected to design a descriptive investigation to explore the effect of force on an object such as a push or a pull, gravity, friction, or magnetism.

SCI 6.8 A: The student is expected to compare and contrast potential and kinetic energy.

SCI 6.8 B: The student is expected to identify and describe the changes in position, direction, and speed of an object when acted upon by unbalanced forces.

## Materials:

- Cotton swab
- Craft stick or tongue depressor
- Cup
- Dental floss
- Markers (optional)
- Pencil
- Poster board or cardstock
- Scissors
- Water

## How To:

*Part 1: Create a mini bow and arrow.*

*Each bow and arrow that you make requires one craft stick, one cotton swab, and approximately 15 inches of floss. These instructions will take you through the process of making one mini bow and arrow, but we recommend making multiple!*

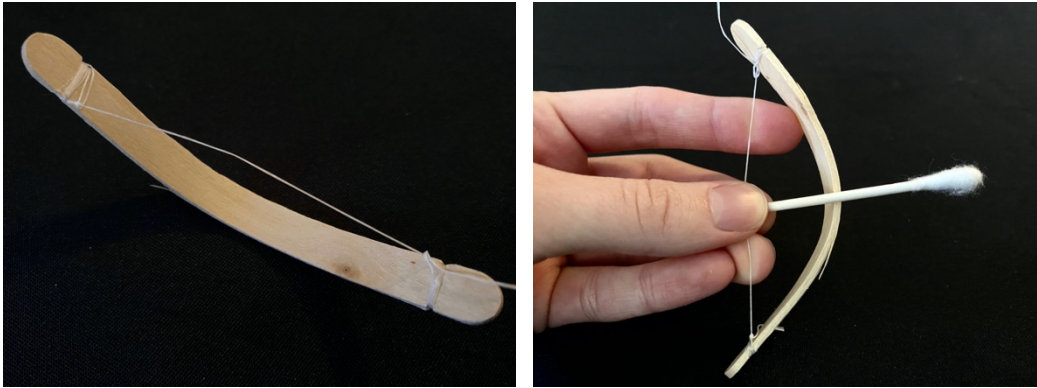
1. Use scissors to carefully cut small notches on both sides of the craft stick, approximately  $\frac{1}{2}$  an inch from each end.
2. Soak the craft stick in water for one hour. This will allow it to bend without breaking as you construct your bow.

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3. Tightly wind a piece of dental floss around one end of the craft stick 2-3 times, making sure it catches in the notches. Tie 2-3 knots to secure.
4. Gently bend the craft stick into a crescent or shallow "U" shape and, while the craft stick is bent, wrap floss tightly around the opposite end of the craft stick 2-3 times, making sure it catches in the notches. Tie 2-3 knots to secure and cut off any excess floss.
5. Cut the cotton tip off one end of the cotton swab.
6. Position the non-cotton part of the cotton swab on the bow's floss. Pull back on the cotton swab arrow and release it!



*Part 2: Create a heart target.*

1. Take out a sheet of poster board or construction paper.
2. Draw a small heart in the center of the paper and progressively larger hearts around it.
3. Label each heart with a point value, making sure the smallest heart is worth the most points.
4. Optional: Use markers to decorate your heart target!
5. Place your heart target on the ground. Use your mini bow to launch cotton swab arrows at the target to see how many points you can score!



**STEM Explanation:**

This lesson required math skills to add up your points and an understanding of physics to create a working bow and arrow. Were you surprised how far the teeny-tiny craft stick bow launched your arrow? A bow and arrow is designed to maximize the amount of energy it can store, specifically potential energy.

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Potential energy is energy that is stored by an object, and a bow is a special type of spring that can store a *lot* of potential energy. When you pull a bowstring (dental floss) back, your muscles exert a force that causes the limbs of the bow (craft stick) to bend toward your hand. The more that you pull the bowstring and bend the limbs, the more potential energy the bow stores. Then, when you release the bowstring, you release the stored potential energy! If you have something resting on the bowstring, like an arrow (cotton swab), this released potential energy is transferred into the arrow and turns into kinetic energy. Kinetic energy is the energy of motion and can cause regular-sized arrows to fly at over 200 miles per hour!

### **Career Connection:**

*Mathematicians* study numbers, data, quantity, structure, space, models, and change. They analyze all kinds of measurements and types of data and use mathematical techniques to help solve problems in the world. They often work with teams of scientists and engineers.

*Physicists* study the natural world, from the tiniest subatomic particles to the largest galaxies. They do experiments to discover the laws of nature. They study what things are made of (matter) and how things behave. They also learn about energy, studying how it changes from one form to another.

### **Resources:**

<https://untamedscience.com/archery-physics/>

<http://physicsbuzz.physicscentral.com/2009/02/howd-they-do-that-tuesday-bow-and.html>

<http://www.native-languages.org/weapons.htm>

<https://teachbesideme.com/valentine-stem-blow-dart-math/>

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