Siege Engines for Kids

Ah catapults - a classic and exciting engineering project that introduces students to some fundamental ideas in physics and engineering. Stored energy, trajectory, the value of density in projectiles, and of course firing stuff across the room!

Learning Objective

Students will...

Use a hands-on approach to explore and comprehend basic concepts in engineering and physics like stored energy, trajectory, reinforcement, density, levers and hinges, and trusses.

Acquire an understanding of the different parts of a catapult: the base, the support structure, the arm, and the basket.

Strengthen critical thinking and motor skills as they build their siege engines and troubleshoot any design flaws that may arise.

Materials: Craft sticks, craft cubes, cubes with holes, rubberbands, skewers (less than 1/8" diameter), corks, plastic cups, paper, tape, and hot glue.

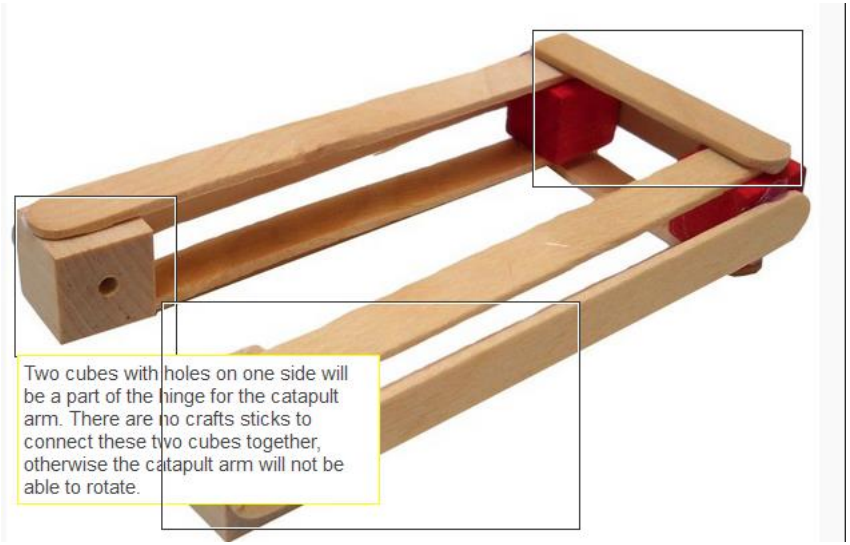
Each mini siege engine is built differently, so I will outline how to build the individual models in the following steps. For now, let's focus on what these little war machines have in common:

Trusses: I explain to the students what a truss is and why it's so strong and useful. Trusses are basically triangles that are used to strengthen a structure. Trusses do not change their shape easily, unlike squares which can flatten into rhombuses (sometimes I will make a triangle and a square out of craft sticks and show the students how easy it is to squash a square, but not a triangle). Trusses also require very little materials which makes them highly efficient. The catapult in the photo above uses trusses to support the downward pull of the catapult arm. If the trusses were replaced with a pair of beams perpendicular to the base, the whole support structure would collapse if the arm were to be pulled down.

Reinforce: This is easy to explain - reinforce simply means adding more material to make something stronger, like gluing sticks on all sides of the base instead of just one.

Trajectory: I explain that trajectory is the path that an object, or projectile follows through the air. What happens when the projectile is aimed upward at 45 degrees? The trajectory it takes will be a nice smooth arc. Aimed straight forward? Immediately begins to fall toward the ground. (Just like in Angry Birds - kids can really relate to this!) Changing the trajectory will change how the projectile moves. Most kids understand this intuitively.

Step 1: Simple Catapult

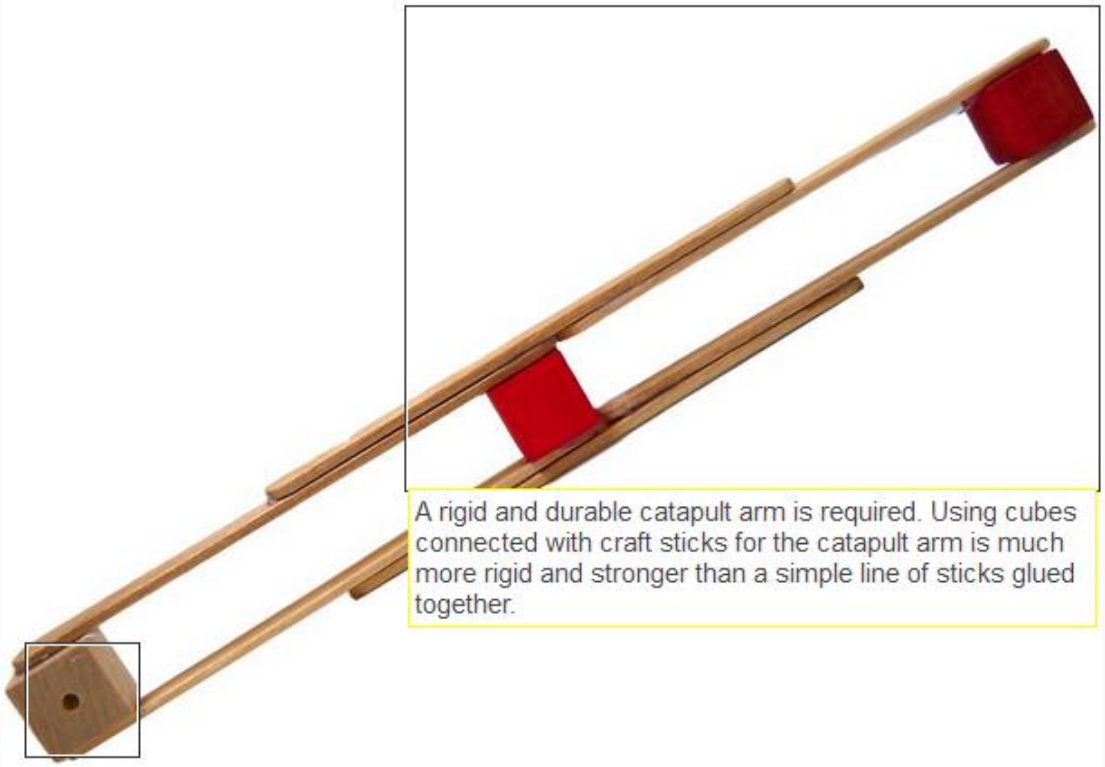


Two cubes with holes on one side will be a part of the hinge for the catapult arm. There are no crafts sticks to connect these two cubes together, otherwise the catapult arm will not be able to rotate.

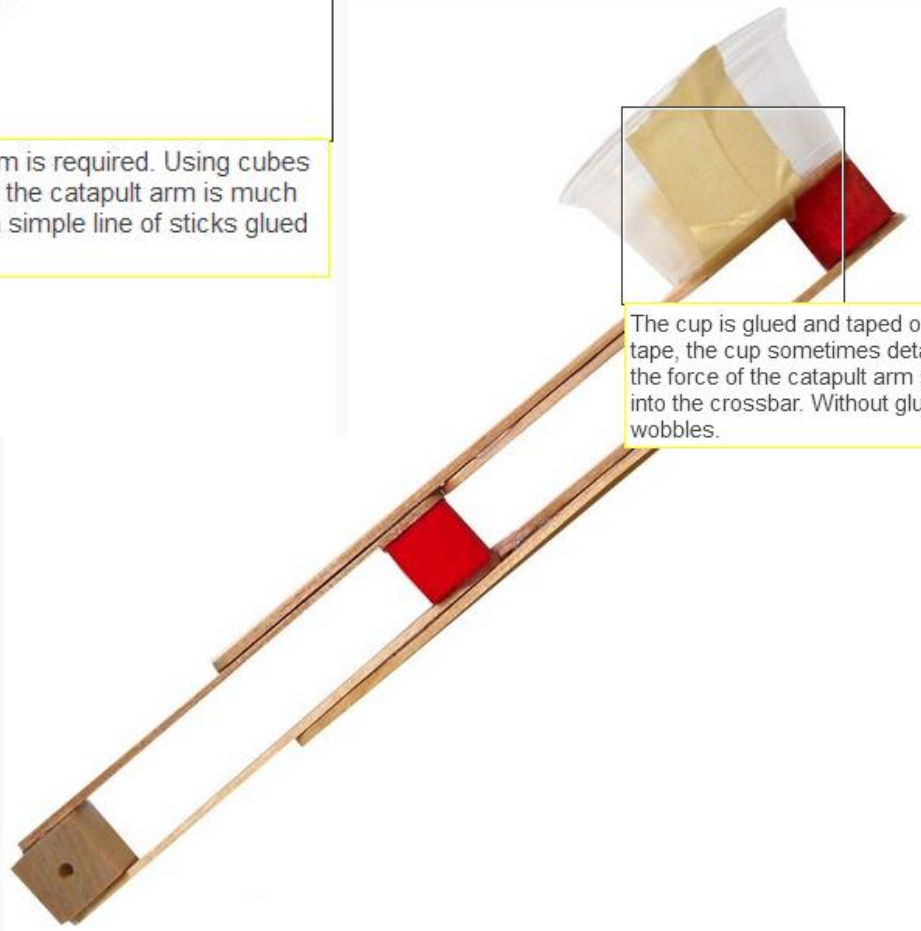
1/2 craft sticks are used for the width of the catapult. The reason for this will be explained in the 7th photo

Sticks are glued to three sides of the cubes to reinforce the base

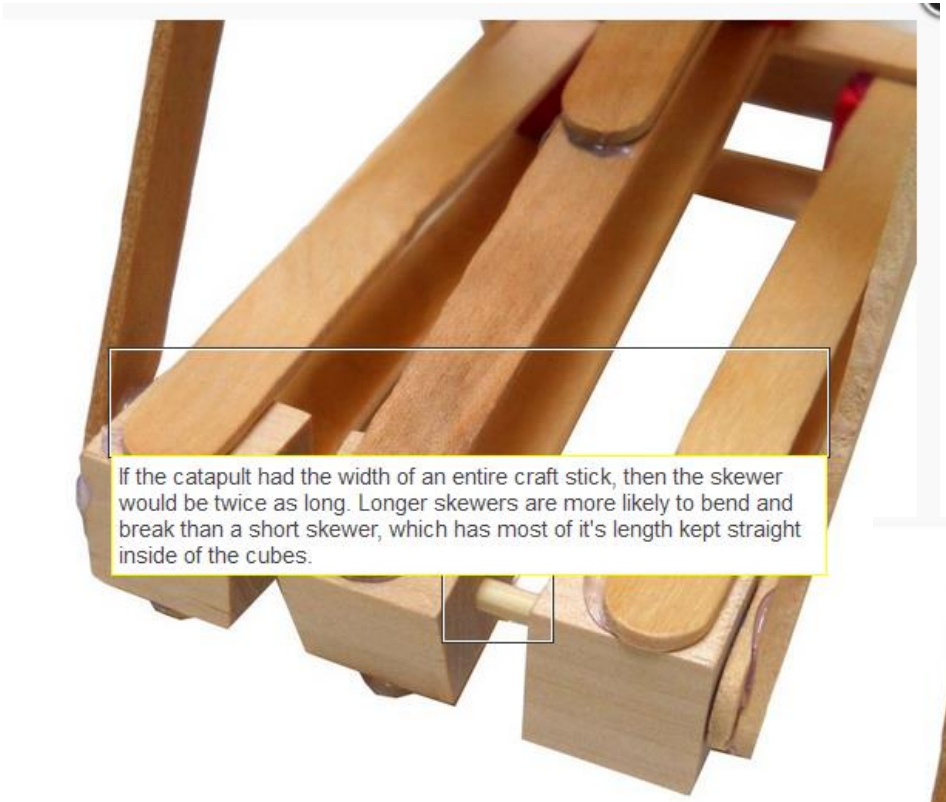

The crossbar has at least two sticks connecting the cubes together



A rigid and durable catapult arm is required. Using cubes connected with craft sticks for the catapult arm is much more rigid and stronger than a simple line of sticks glued together.



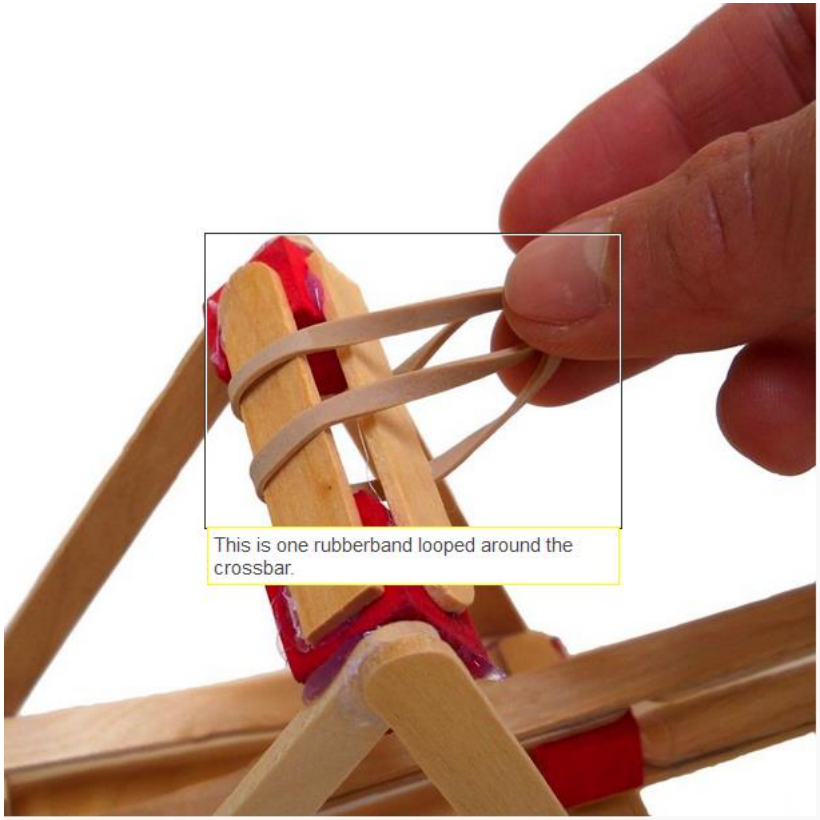
The cup is glued and taped on. Without tape, the cup sometimes detaches from the force of the catapult arm smacking into the crossbar. Without glue, the cup wobbles.



If the catapult had the width of an entire craft stick, then the skewer would be twice as long. Longer skewers are more likely to bend and break than a short skewer, which has most of it's length kept straight inside of the cubes.

Use a small piece of skewer to thread the cubes with holes together. It should be fairly easy to part the base cubes enough to fit the skewer in.


Looking good! The last step is to attach the rubberbands.



This is one rubberband looped around the crossbar.

Pull the rubberband over the catapult arm


Add more rubberbands for more firepower!