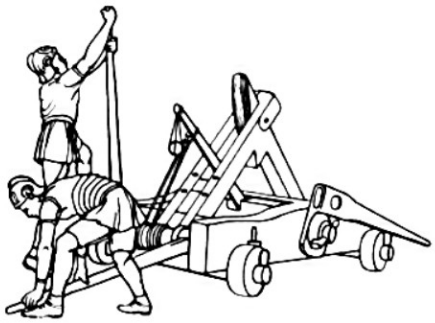
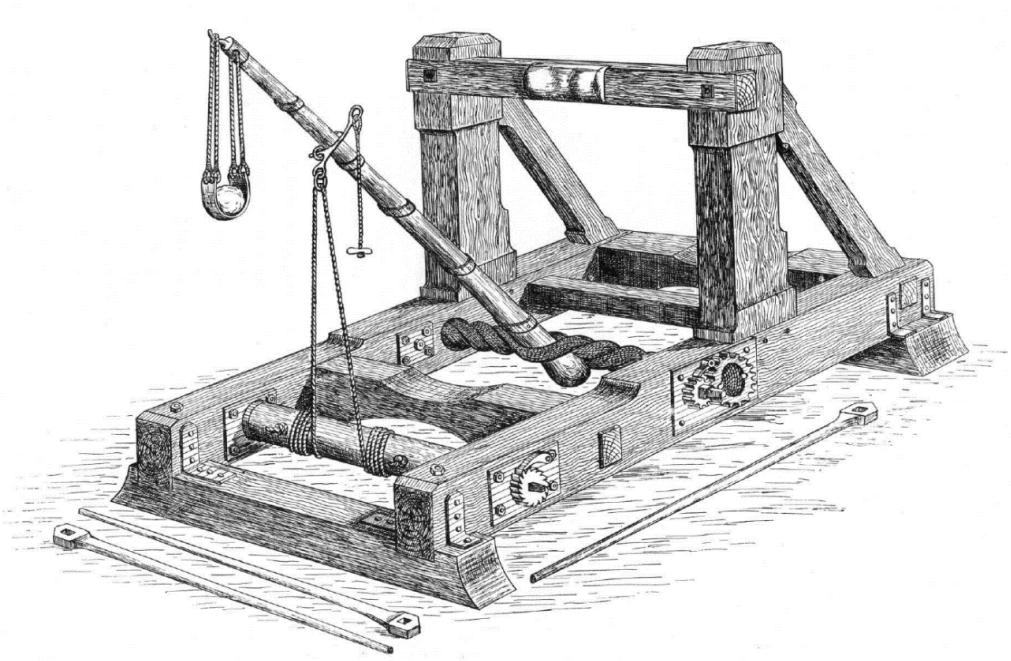
History at Home: Onager Catapult Activity

The Ancient Romans were able to conquer the lands around the Mediterranean through their military genius. They were disciplined soldiers, who often adopted the successful tactics of those they fought, and created war machines to help defeat their enemies. One of these war machines was the onager, a small catapult used by the Roman Army during the Roman Empire. The catapult was used during sieges to break city walls and buildings and to terrify the enemy. The onager got its name from the kicking action of the machine. The rear end tended kick up when it launched a stone and looked similar to type of wild donkey, called an onager, kicking its hind legs.





The device had a single vertical wooden beam that was stuck through a thick horizontal **skein** of twisted ropes. These heavy ropes were thought to have been made of horse hair, human hair or even animal **sinew**. As the bucket or sling on the end of the beam was pulled down to the ground and loaded, the skein of ropes was further twisted and tightened by a geared **winch.** Twisting the ropes this way creates **torque,** a rotational force. A locking gear prevents the catapult from launching until the gear is released.

Loading the onager creates **potential energy**. Potential energy can be thought of as the energy held by an object. It can be converted into another type of energy called **kinetic energy,** the energy of motion**.** Energy cannot be created or destroyed, but it does change from one form to another. When the gear is released, the stone is launched into the air, turning the potential energy into kinetic energy.

This is kind of like what happens when you stretch a rubber band. You are creating potential energy by stretching it out. Stretching it creates stresses in it. These stresses are potential energy. When you release one end of the rubber band, you release the potential energy you created to allow it to become kinetic energy, and the rubber band snaps back quickly.

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Now you are going to apply what you learned about the onager, and make a small version of your own. This onager will rely on stresses in the object itself to create the potential energy.

Materials required:
5 popsicle sticks, 6 rubber bands, plastic spoon

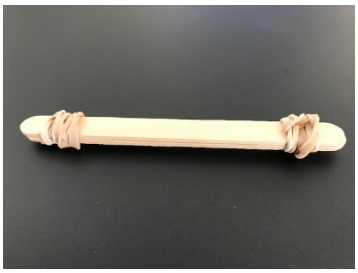
Vocabulary:

1. **skein:** a loosely coiled length of rope, yarn, or thread wound around itself.
2. **sinew:** a piece of tough fibrous tissue that connects muscle to bone or bone to bone; a tendon or ligament.
3. **winch:** mechanical device that lifts heavy objects by turning a chain or rope around a cylinder.
4. **torque:** rotational force, or more specifically, a measure of the force that can cause an object to rotate around an axis.
5. **axis:** is a real or imaginary line that something rotates around.
6. **potential energy:** the energy held by an object because of its position in relation to other objects, stresses within itself, its electric charge, or other factors.
7. **kinetic energy:** the energy that an object has due to its motion.

Activity Directions:

1. Take three popsicle sticks and a wrap rubber band tightly around each end. This creates a popsicle stick bundle.

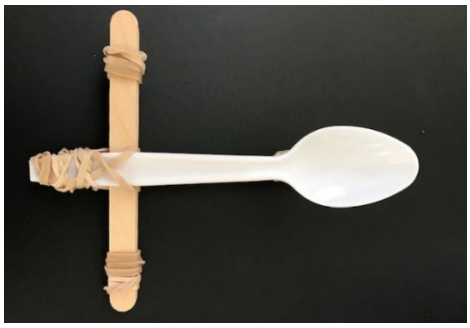
2. Take two popsicle sticks and wrap a rubber band tightly around each end.



3. Attach the plastic spoon to the smaller popsicle stick bundle at the handle end with a rubber band.

4. Put the larger bundle of popsicle sticks between the spoon and the smaller bundle of popsicle sticks.

5. Push the larger bundle towards the handle end of the spoon and secure it with a rubber band. Start at the handle end of the spoon. Hold the rubber band to the back of the small bundle while you stretch it and cross it over itself to make an X. It will need to be stretched over the spoon as well. Then tighten the rubber band by looping over the spoon handle and the small bundle several times.



6. Your catapult is finished and you can now test it out by launching small objects with it.