

Counterweight trebuchets were once a behemoth of a weapon, considered the most powerful siege weapon during the medieval period. Nonetheless as history moved on, the trebuchet was slowly replaced with more modern weapons such as gunpowder. Yet its use of counterweight has been applied in many modern designs we use everyday, including cranes and elevators.

Counterweight trebuchets have five main parts. When they are able to fluently and correctly work together, the trebuchet becomes a weapon of mass destruction, granting victory to whichever side best utilizes it in war.

A trebuchet consists of the frame, which holds the trebuchet above ground level. The height of the frame is important because if too low, the counterweight will not fall far enough, and the sling won't reach maximum altitude. In some designs, large trebuchets have wheels attached for mobility.

The second part of the trebuchet is the axel, which is connected to both sides of the frame. A beam is attached to the middle of the axel, allowing the beam to move up and down when released. This axel allows the counterweight to freely drop, instead of the beam being rigidly in place. This means that people will have to hold the sling down so the counterweight doesn't drop before the designated time.

The third part of the trebuchet is the beam. The beam is connected to the axel, and has both the sling and counterweight attached to it. However, the counterweight is attached to a shorter part of the beam, while the sling is on the far side, allowing the sling to get higher in the air.

The fourth part is the counterweight, which we will be testing in this experiment. The counterweight falls down to the ground when released, causing the other side of the beam, where the sling is, to launch upwards. This is similar to a seesaw when something heavier is layed on the bottom. This means that for our trebuchet to reach maximum efficiency and distance, our counterweight has to be as heavy as possible. Still, if our counterweight reaches a certain point where when it falls down due to gravity, the speed of the fall will remain the same, rendering the extra weight useless.

The fifth and last part of the trebuchet is the sling and projectile. The sling is attached to the beam so that when the counterweight falls, part of the sling will release, allowing the projectile snugged tightly in the sling to be launched. Due to Newton's second law of motion, which is $\text{Force} = \text{Mass} \times \text{Acceleration}$, we can conclude that the heavier the projectile, the more damage it can inflict. (Gamache, Hamilton. Trebuchets: The Effects of Mass of the Counterweight). Because of this, increasing the size and weight of the projectile will also mean increasing the load of the counterweight.

Every trebuchet has many variables. Those include the weight of the projectile, counterweight, height of the frame, length of the beam, elasticity of the sling, and the distance between the center of the axel and the counterweight. To properly test one of these variables, all the other variables have to be neutralized, meaning we have to use the same trebuchet to prevent design imperfections.

The first historical trace of the counterweight trebuchet was recorded in 1124, used in the siege of Tyre. It was continuously used through the medieval ages, until it's last use by Hernan Cortes against the Aztecs. Even though the trebuchet is no longer built and implemented in modern day warfare, it's properties have affected many important inventions and served as one of the many building blocks of our world.