

Objective Build a tensional catapult or trebuchet that will launch a tennis ball the greatest possible distance.

Rules and Specifications

1. You may work alone or in pairs. No groups of three. Your partner must be in the same period.
2. A catapult is NOT a cannon; that is, you may not depend on compressed gases (or burning gases for that matter) to launch your tennis ball.
3. **A catapult is NOT a slingshot**; that is, you may not depend on stretched rubber bands (or any elastic energy stored in rubber or plastic) to launch your tennis ball. This means no doggy ball launchers. The only exception to this rule is that you may make a torsional catapult, which relies on wound-up rubber bands to flip a lever arm.
4. A catapult is NOT a tool for amplifying your own strength. Please design a launch trigger, switch, pull-cord, or other type of passive mechanical launch mechanism. Most importantly, you may not push or pull the lever arm during launch to increase your launch velocity.
5. You may use the internet as a resource in your design, but you may not build the catapult from any pre-packaged kit. If you plan on using any power tools, you **MUST** consult your parents regarding safety.
6. You may not spend more than \$15 per catapult for *all* materials (including your own tennis ball). This requirement is **on your honor**. If you are using materials from your garage/basement/closet, you **must** estimate the cost of these and include them in your total. The only exception to this rule is if you find objects on the street, in the trash, on the beach, etc.
7. The catapult may NOT exceed 0.5 m x 0.5 m x 1.0 m, (length, width and height) when in its pre-launch stored position. The catapult may exceed these dimensions during the launch swing.
8. Your grade depends on how far the catapult sends the tennis ball. See grading guidelines below.
9. You must use wood or metal for the ‘lever arm’. String slings at the end (like a trebuchet) are OK.
10. Your catapult must be safe when it launches. If the catapult jumps violently, breaks violently, or otherwise endangers students, you will be penalized.
11. Test your catapult *in advance* for accuracy, durability, etc. If it breaks during launch, we can’t help you.
12. Bring one or more tennis balls and label them with your name using a marker.
13. You will bring in your catapult, launch it, and bring it home or to the dumpster all on the same day. Make sure you can get it here and get it home; we will NOT store any catapults. Arrange for help carrying it.
14. Think about the physics – angle, energy, etc. – in your design. We’re happy to help you troubleshoot before the day of the launch. **Don’t wait until the last minute! That is a prescription for frustration.**
15. Failure to follow any of the rules above will result in a loss of at least 20 yards, at the instructors discretion.

Your Grade

1. During class, you get three graded launches, and we will give you the grade of your best launch. The measurement will be based on where the ball first lands, **not** where it rolls to a stop.
2. Your grade on this project depends **solely on the distance the ball travels**. It is quite difficult to get an A.
3. There *may* be a short bonus round after all the catapults have launched and been graded. You can set up your catapult a distance of at least 10 yards away and attempt to hit your teacher or a substitute chosen by the teacher. If you hit the target on your first or second attempt, you add 5 yards to your score above. For reasons of safety, the tennis ball must be on its way *down* when it hits the target.

Grade	Δx (yards)
A	$45 \leq \Delta x$
A-	$40 \leq \Delta x < 45$
B+	$35 \leq \Delta x < 40$
B	$30 \leq \Delta x < 35$
B-	$25 \leq \Delta x < 30$
C+	$20 \leq \Delta x < 25$
C	$15 \leq \Delta x < 20$
C-	$10 \leq \Delta x < 15$
D+	$8 \leq \Delta x < 10$
D	$0 \leq \Delta x < 8$
D-	$-\Delta x$

Internet Resources

1. http://en.wikipedia.org/wiki/Medieval_siege_weaponry
2. <http://en.wikipedia.org/wiki/Catapult>
3. <http://en.wikipedia.org/wiki/Trebuchet>

ANTICIPATED LAUNCH DATE: DAY 2, WEEK OF OCTOBER 10th
(TUESDAY for 1st & 3rd periods, WEDNESDAY for 6th and 7th)