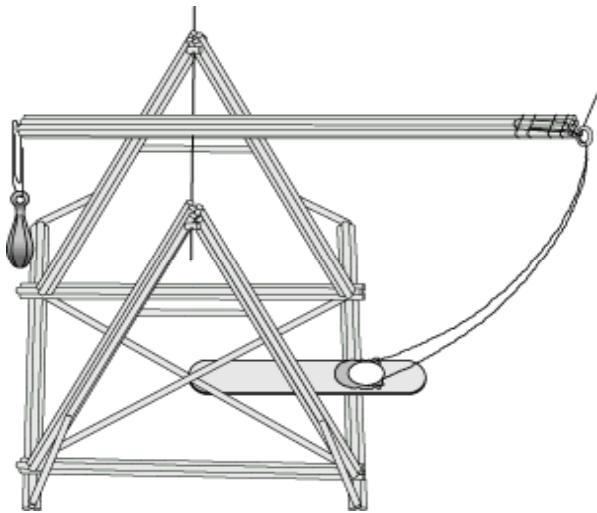


# TREBUCHET PROJECT 2014



**PURPOSE:** The purpose of this project is to build a trebuchet which will fling a projectile as far as possible

**DISCUSSION:** We have been watching a film about the considerations that medieval engineers had to make when constructing a siege engine. Essentially, they used locally available materials to build a machine which could heave a projectile a long way with enough *ENERGY* to knock down a castle wall. You will be doing the same, only on a smaller scale. The trebuchet is nothing more than a big see saw (First Class Lever) with a large counterweight at one end, a "flinging" mechanism at the other, and a structure built to support the lever arm.

**MATERIALS:** popsicle sticks, wire, paperclips, duct tape, fishing weights

## PROCEDURE:

1. Research trebuchet designs (the internet has plenty of examples). Take note of how long the lever arm is, where the axle is, how the lever arm is supported, how high off the ground it must be, how it pivots during use, etc. Also take note of how the support structure must be built to facilitate the swinging of the arm. Pay special attention to the bracing points and the reinforcements.
2. Your trebuchet must be constructed only from the materials supplied to you. The mass of your trebuchet (not counting the counter-weight or projectile) cannot exceed **100 grams**. This is roughly the combined mass of 60 popsicle sticks and one meter of duct tape. Excess mass will be penalized.
3. You and your partner must have a construction plan so you can maximize in-class construction time. You will also definitely want time to test and tweak your project so **WORK EFFICIENTLY!**
4. Your lever arm must have the following two features: a hook from which to hang the counterweight and a hook to which the projectile sling will be attached. **YOU DO**

**NOT "OWN" THE COUNTERWEIGHT/PROJECTILE PACKAGE.** These items will be shared between all the classes so the counterweight cannot be permanently attached.

5. You must also engineer your trebuchet so that it does not fall over after it flings the projectile! In the past, we have had student-built trebuchets that flung projectiles well but fell over every time. This is simply impractical and poor design.

#### **TESTING:**

Each trebuchet will be tested using the same counterweight and projectile package. It is very simple, the further the projectile goes, the more points you get! If your trebuchet falls over, you lose points.

#### **TIMELINE**

**DAY 1** (the day you receive this sheet) - A. Make sure you thoroughly understand the assignment. B. Your homework for tonight is to research trebuchet designs and look at many different trebuchet examples.

**DAY 2** - Partners assigned / Engineering meeting. Your team will meet to discuss how you will go about building a successful trebuchet. You will need to prepare a **CONCEPT SKETCH** of what the final product will look like (how tall will it be?, how wide?, how long should the lever arm be? Etc.). You may use popsicle sticks but **NO TAPE** on this day.

**DAY 3** - Construction Day 1. Begin building. Work efficiently! If you finish your trebuchet today, you will have all day tomorrow to test and tweak it. **You should bring in a shopping bag in which to store your partially completed project and spare parts.**

**DAY 4** - Construction Day 2. You should be **DONE** with construction by the end of class today.

**DAY 5** - Test Day. You will get the first 15 minutes of the period to make final adjustments on your trebuchet. We will then test them. The homework will be to complete the Follow up Questions.

## **SCORING:**

The entire project is worth 90 points. The points are added up in this way:

5 points - ready to launch when called

10 points- Design

- no obvious design flaws (like, you forgot to build a lever arm),
- trebuchet has counterweight and sling hooks.
- mass limit not exceeded

20 points- Quality of construction/durability

- stands freely with no obvious sagging, collapsing, etc. (10 pts)
- lever arm swings freely (5 pts.)
- able to launch min. 3 times without self destructing (5 pts.)
- (Trebuchet falls over after launch = 40% penalty on the distance.  
Example - your trebuchet flings the projectile 20 feet. If it falls over, your throw distance is reduced to 12 feet)

25 points - Performance

- "It launched" = 10 pts.
- An additional one point for every foot the projectile travels.

20 points - follow up questions.

10 points - Teacher's Discretionary points. Most students should earn 10/10. Some will not. Common infractions may include: not preparing a Concept Sketch, not bringing in a bag in which to store your parts, not cleaning up after one's self, or, the general category of "poor citizenship".

Even if you don't build a great siege weapon, you can still earn a decent score on this project. You just have to work hard to ensure that you don't lose any "easy" points.

## **OTHER ITEMS**

- All construction on this project must take place in school.
- Symmetrical = Good
- Make sure you leave clearance for the counterweight to swing freely
- Build the lever arm last but be sure to set aside sufficient building materials.
- TALL is good (more potential energy for the counterweight). BUT, you have limited materials. If you build it too tall, it will probably be unstable and fall over or fall apart when it launches. Be careful with your design.

**GOOD LUCK AND HAVE FUN!**