Trebuchets - **Project**: Build a working Trebuchet and make a movie about it. **DUE March 17.**

This project is worth 400 points (approximately 20% of your 4th 9-weeks grade.)

Requirements: The Trebuchet must be able to launch a water balloon up to 10, 15, and 20 meters at a target. Your trebuchet must be able to vary the distance it fires. It is to be a maximum of **0.9 m wide by 1 m long by 1.1 m tall (not counting arm),** with a maximum **1.2 m** length of arm. You should used marked free weights. Weight of projectile = a water balloon filled with 0.3 liter of water = 0.3 kg of water. **A maximum of 5 people per group.**

You need to provide the water balloons on launch day.

**YOU MUST HAVE A REMOTE TRIGGER ON YOUR TREBUCHET!!!!** - You will need a pin that keeps the trebuchet from launching and at least 6 feet of rope or string attached to pull the pin. If you have no remote trigger then you will not be allowed to launch and will not receive any points for the trebuchet.

As you build the trebuchet you need to document the progress, i.e. take pictures, movies, notes. You will test your device and plot distance (on LoggerPro) thrown versus weight used. You will need to make a way to vary the weight used in your trebuchet. You will need to test it multiple times at each of the weight used. Your trebuchet must make it through all testing, so build it well. Grades will be based upon having a working trebuchet, a diagram of design **before** your begin, data gathered about the trebuchet and graphs to help predict what weights to use for what distance, the lab measuring how far your trebuchet will throw a water balloon, and how close you come to the target during the final test, but most of your grade will come from your lab report.

You must take part in the building process and have proof (pictures) that you helped.
No using trebuchets built for other classes or clubs.

Due dates - Feb 03, 22, March 17, 27, April 11
    Feb 03 - Must show evidence of research, have a design drawn out, and evidence of having materials purchased.
    Feb 22 - Must show evidence of work on trebuchet. (Pictures and movies)
    March 7 - Must show evidence (pictures and movies) of a working trebuchet and data from multiple trials. Trebuchet video showing at least a 10 meter launch.
    March 17 - Trebuchet due, must have video of a 10-meter, 15-meter, and 20-meter launch, graphs and data ready on this day. You will need to record video of your launches and take pictures during the testing day.
    March 27 - Retesting if your Trebuchet did not perform as well as you would have liked then you can retest it after school today. You can earn a max of 90% of the overall grade.
    April 11 - Movie and Reflection Questions Due.

Your grade will be comprise from meeting the due dates, having a working trebuchet, having data and a graph about your trebuchet that you used to hit your target, how efficient your trebuchet is, answering the Reflection Questions, and filling out an evaluation about the project.

<u>0% = Your group fails to clean up the testing area or you fail to take home your trebuchet on testing day.</u>

<u>-10% if your trebuchet does not meet the size requirements in 1 of the dimensions.</u>
<u>-20% if your trebuchet does not meet the size requirements in 2 of the dimensions.</u>
<u>-30% if your trebuchet does not meet the size requirements in 3 of the dimensions.</u>

<u>0% = Throwing the water balloons at anyone or anything! Only water balloons launched by trebuchet are allowed.</u>

Efficiency (Z) is measured by the distance a projectile travels divided by the amount of weight needed to launch it. The farther it goes with less weight used the more efficient the trebuchet is. Efficiency grade is compared to the other trebuchets built. Top efficiency will get 100 points towards your 400 points for the project. All other trebuchets will be compared to the most efficient trebuchet. For instance if the top trebuchet went 20 meters with 10 lbs of weight it would have an Z-value of 20 m / 10 lbs * 100 = 200 m/lbs, if your efficiency is 120 m/lbs then you would get 120 / 200 = 60% of 100 pts = 60 points.

You will get up to a _____ if you have a:

100% = Working Trebuchet that launches a water ballon up to 20 meters, meets the size requirements, answered the Reflection Questions, recorded data about trebuchet weight used vs distance travelled and plotted in LoggerPro. A working trebuchet that you have video proof launches 10, 15, and 20 meters. Proof means you and your teammates are in the video and you show the distances marked out. Also your trebuchet must be able to show it can fire a **water balloon** the different distances. The build process has been well documented with pictures and movies of the build process. You have met all deadlines, You also have followed all of the rules. **YOU CLEANED UP THE TESTING AREA AND TOOK YOUR TREBUCHET HOME BY THE END OF THE TESTING DAY.**

90% =Working Trebuchet that launches a water ballon up to 15 meters, meets the size requirements, answered the Reflection Questions, recorded data about trebuchet weight used vs distance travelled and plotted in LoggerPro. A working trebuchet that you have video proof launches 10, 15, and 20 meters. Proof means you and your teammates are in the video and you show the distances marked out. Also your trebuchet must be able to show it can fire a **water balloon** the different distances. The build process has been well documented with pictures and movies of the build process. You have met all deadlines, You also have followed all of the rules. **YOU CLEANED UP THE TESTING AREA AND TOOK YOUR TREBUCHET HOME BY THE END OF THE TESTING DAY.**

80% = Working Trebuchet that launches a water ballon up to 10 meters, meets the size requirements, answered the Reflection Questions, recorded data about trebuchet weight used vs distance travelled and plotted in LoggerPro. A working trebuchet that you have video proof launches 10 meters. Proof means you and your teammates are in the video and you show the distances marked out. Also your trebuchet must be able to show it can fire a **water balloon** the different distances. The build process has been well documented with pictures and movies of the build process. You have met all deadlines, You also have followed all of the rules. **YOU CLEANED UP THE TESTING AREA AND TOOK YOUR TREBUCHET HOME BY THE END OF THE TESTING DAY.**

75% = Working Trebuchet that launches a water ballon up to 5 meters, meets the size requirements, answered the Reflection Questions, recorded data about trebuchet weight used vs distance travelled and plotted in LoggerPro. A working trebuchet that you have video proof launches 5, and 10 meters. Proof means you and your teammates are in the video and you show the distances marked out. Also your trebuchet must be able to show it can fire a **water balloon** the different distances. The build process has been well documented with pictures and movies of the build process. You have met all deadlines, You also have followed all of the rules. **YOU CLEANED UP THE TESTING AREA AND TOOK YOUR TREBUCHET HOME BY THE END OF THE TESTING DAY.**

70% = Working Trebuchet that launches a water ballon forward, meets the size requirements, answered the Reflection Questions, recorded data about trebuchet weight used vs distance travelled and plotted in LoggerPro. A working trebuchet that you have video proof launches 5 meters. Proof means you and your teammates are in the video and you show the distances marked out. Also your trebuchet must be able to show it can fire a **water balloon** the different distances. The build process has been well documented with pictures and movies of the build process. You have met all deadlines, You also have followed all of the rules. **YOU CLEANED UP THE TESTING AREA AND TOOK YOUR TREBUCHET HOME BY THE END OF THE TESTING DAY.**

On test day:
You will get a maximum of 4 attempts to launch a water balloon (time permitting).

Extra credit: (Maximum of 15% extra credit)
- Up to 10% You make a creative movie that involves your trebuchet (Think Monty Python and the Holy Grail)
- Up to 5% If you have creative attire on to match your trebuchet, i.e. costumes are encouraged (school appropriate)!
- 5% Hitting target with water balloon launched from trebuchet or
- 2% Splashing target with water from water balloon launched from trebuchet.

Trebuchet Lab Report should include the following pages:
- A video introducing the project and team, along with written descriptions.
- Written and visual instructions on how to build with pictures of the build, (A movie explaining the step by step process.)
- Movies of test launches, Data & graphs
- Results / Conclusions / How to improve
- Credits - Citing where you got your information
- How was work divided among group members, who did what.

** If your trebuchet fails or you are unhappy with the performance on test day you may rebuild it, filming videos/taking pictures of the rebuild process and videos of the rebuilt trebuchet working, launching 10, 15, and 20 meters multiple times. The video of the rebuild and a working trebuchet will need to be submitted the day we come back from Spring Break March 27. You may receive a maximum grade of 90% on the rebuild if all requirements are met.

Trebuchets can be placed into four different categories:
1   the swinging counterweight,
2   the fixed counterweight on a fixed frame,
3   the fixed counterweight on a floating frame, and
4   the floating arm (FAT) trebuchets.
5   King Arthur Trebuchet
6   Merlin
7   and many many more

PLEASE NOTE: Do not expect Mr. Thomas or Mr. Womack to help you. If you have taken their classes and know how to use equipment, they MAY choose to help, but you should not expect them to do so.