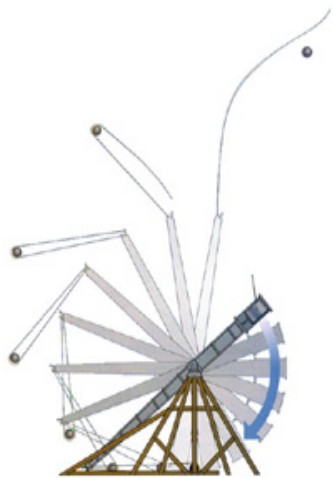


All WHS Physics Classes – 2021 Siege Engine Project



*Purpose: Build a siege engine that will launch a water balloon 35 meters and then use vectors and kinematics to analyze the balloon's trajectory. **Our 10th annual Treb Day!***

Assigned on: Monday September 27th, 2021 → Value = 100 Pts.

Performance Due Date: Friday, October 29, 2021 (Trebuchet only – 50 Pts.)

Journal Due Date: Thursday/Friday, November 11 & 12, 2021 (Journal only – 50 Pts.)

1. Materials:

- ✓ The use of recycled materials is encouraged.
- ✓ Only gravitational potential energy can be used to move your trebuchet. The use of motors, fuel, propellants, elastics, or hydraulics is prohibited.
- ✓ Your group needs to provide balloons for all test and official launches.

*****Helium-grade balloons are strongly recommended!*****

2. Rules and Physical Requirements:

- ✓ The trebuchet must be able to be handled safely by no more than 2 people and must be safe in nature (sturdy, solid, etc.) with no exposed nails/screws. You will be required to pass a safety inspection before being allowed to fire your trebuchet. Students will be given the opportunity to correct any deficits that fail the safety inspection.
- ✓ The trebuchet *must* have a safety trigger that releases the projectile. The trigger should be able to be “pulled” by only one person at a safe distance (2 meters or more) normal to the plane of action of the throwing arm.
- ✓ The trebuchet must have a throwing arm less than or equal to 1.75 meters in length. (Total length of arm)
- ✓ On the due date, trebuchets are to be brought to school. Design your machine so that it can be moved! Your group will have three (3) official tries to complete the task. Your group will be allowed plenty of “warm up” shots.
- ✓ You can form groups of no more than 3 people, which can be from ANY WHS Physics class. Your group will share the performance grade but each member must complete the journal independently. *Choose wisely!* You will be required to identify your group *members* & group *name* no later than **Friday October 1st.** Use this form to declare which project you will work on (classic or alt), teammates, & name: <https://forms.gle/jDJoV6468QKk9DnP7>
- ✓ **Your trebuchet must be built by you and your team. Borrowing or purchasing someone else's old machine is strictly forbidden.** Your journal must include three (3) pictures of team members with the trebuchet in various stages of building & development (pic 1: unpainted & completed base, pic 2: unpainted & completed throwing arm with sling, pic 3: completed). Additionally, each team member will report their contribution to the project.
- ✓ Your project must take the form of a trebuchet. Other forms, such as a slingshot or ballista, will *not* be acceptable.

3. Grade: Your project will be graded in two parts: *Journal (50 points) and Performance (50 points)*

A. Journal (50 points): Each person in a group must produce a unique journal that should have a cover sheet or creative binding. It will be due on November 11th and 12th, and must contain:

1. Full-page orthographic projection (four total sketches: front view, side view, top view plus 3D view) neatly hand drawn or with CAD of final trebuchet design including all major dimensions.
2. Calculations including: X and Y components of velocity, initial velocity vector shown graphically (as the sum of the components) and calculated analytically, and maximum height. You will be supplied with the time of flight and range of your projectile.
3. A written discussion of your major design considerations. Specifically, placement of the main axle on the throwing arm, throwing arm material and geometry, structural integrity, counterweight type, and sling fabrication and design. Modifications to design, experimentation and trials should also be discussed here.
4. References & Build Pictures – include all sources of information. Include 3 pics from build.

*****WARNING WARNING WARNING WARNING WARNING*****

Under no circumstances is there to be any inappropriate use of the water balloons.

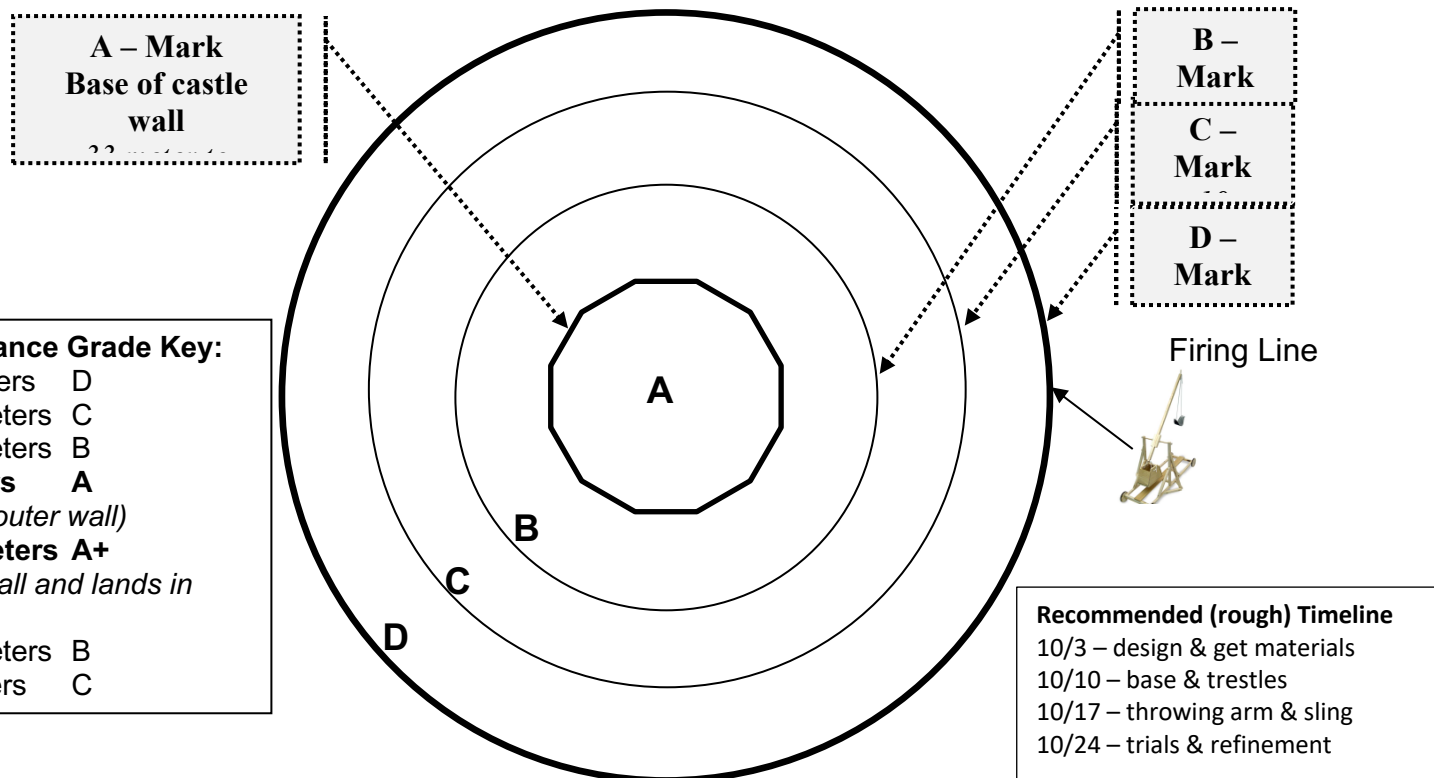
Horseplay is unacceptable and will result in administrative and academic penalties.

Your Group Performance Grade for this project will be 0%. There are no exceptions.

B. Performance (50 points): This grade will be common to the entire group.

All siege engine teams will be randomly assigned a launch area along the perimeter of the circular field. The field will have a radius of 35 meters. The castle will be centered at the 35-meter mark and will have a general radius of about 2 meters (it is a dodecagon, not a perfect circle) with a main wall height of 1.2 meters with a 30 cm square crenellation pattern.

Your distance will be measured from the firing line to the spot where your projectile first hits the ground. Your goal is *distance accuracy* and your performance grade will be determined using the following field layout:



4. Bonus: You have several opportunities for bonus points → up to 20 points total bonus!

A) Bull's-eye: Mr. Kaplo or Ms. Shaka will be standing atop the castle wall - hit your target(s) *on one of the three official shots* and receive a **20% group bonus on the performance grade (10 points)**. Your names also get engraved & mounted on the wall of the physics lab F310 on the “silver gear” plaque!

B) The Ken Burns Approach: Complete a video documentary from initial stages of design to the construction of your trebuchet including footage from launch day. The video should be between 5 – 10 minutes in length and be nicely edited. Complete this assignment and receive *up to a 10% group bonus on the journal* (due at later date with journal). (5 points). Upload to YouTube and share a private link OR share with Google drive.

C) Dress-up: If you dress in traditional medieval attire on launch day (kilts, armor, princess, and so forth), you can earn *up to a 10% group bonus on the performance grade (5 points)*. Alternately, it is OK if costumes are associated with an alternate Treb theme, as long as it school appropriate. ****Sorry – No sharing of attire****

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