

Lewis & Clark Community College 12th Annual Trebuchet Competition

2019 Trebuchet Competition Rules

Design Rules

1. The trebuchet competition is open to all high school students. Teams should be limited to no more than 5 members. Students are not allowed to work on multiple teams. Participating schools are encouraged to submit multiple teams. Teams from outside the LCCC district are welcome but preference is given to district schools. Teams can register at: www.lc.edu/trebuchet
2. **The counterweight (see mass m_1 in fig. 1) for 2019 will be up to 5 unopened cans of soda (you may use fewer).** The counterweight must be detachable and must be
 - a) dangling throughout the entire throwing motion (makes no contact with other parts of the trebuchet throwing arm: $L_2 + L_5$ in fig 1).
 - or
 - b) must be rigidly attached to the arm (can't slide, jiggle, etc....). If the cans are rigidly attached to the arm, it will be included in measurements of the arms length. Rigid is defined as anything other than dangling. If the counterweight comes in contact with the throwing arm, it will be treated as part of the arm for qualification purposes (see fig. 2).
3. Trebuchets from previous years may not be reused.
4. The throwing arm (length $L_2 + L_5$ in fig. 1) must be no longer than 3 feet. The length includes the sling hook (where L_5 and L_3 meet), any mechanism or harness used to attach the counterweight (where L_1 and L_2 meet), and the counterweight itself if contact is made (see #2). The top pivoting lever may not be less than $\frac{1}{4}$ " thick.
5. The throwing arm (length $L_2 + L_5$ in fig. 1) must be balanced toward the projectile end (see L_5) throughout the entire range of motion. It may not be collapsible. The arm cannot be locked in place while testing for balance. Testing will be performed by removing the counterweight and projectile, lifting the projectile end all the way to within 1 inch of the vertical using a pencil, and lowering the arm back to the ground to the cocked position. The arm should stay in contact with the ground when in the cocked position and should not leave contact with the pencil during the testing motion. If the throwing arm leaves contact with the pencil while lifting, or leaves contact with the ground while in the cocked position, it is not in compliance.
6. The height of the center of the pivot point (H) must be less than or equal to 2 feet 2 inches from the ground.
7. All connecting hardware must remain in place during testing. Only the counterweight (soda cans) and projectile may be removed. Any fastening devices/holders/brackets to be used during the competition will be included as part of the arm during the balance test. This includes the sling hook and the counterweight attachment mechanism. You will not be allowed to augment the counterweight in any way (other than an allowance of up to 30" of duct tape used to hold cans together).

8. A firing release mechanism is **NOT** required. However, inclusion of a working firing mechanism is encouraged. If a mechanism exists, it does **NOT** have to be used in competition.
9. No catapults or catapult/trebuchet hybrids are allowed. Only stored energy due to gravity is allowed. You are not allowed to store energy by deformation of components. This means no springs, rubber bands, flexible arms, etc. No pulleys or ball bearings are allowed.
10. The counterweight must be attached to the end of the throwing arm, not looped over.
11. Trebuchets will be inspected for safety. Loose parts must be tightened before competing. No part of the trebuchet is allowed to become completely disconnected from the trebuchet (this includes counterweights falling off). If a part becomes completely disconnected, the trebuchet will be deemed 'lost in battle' and must be removed from the competition. The only exception to this rule is the projectile sling pouch which may be retied or reattached if a string comes loose. Any trebuchet that is considered to be unsafe by the judges will be disqualified.
12. Trebuchets must not have any protruding parts that may damage the surface of the playing field. No metal may protrude below wood or other softer material.
13. Recoiling trebuchets (wheels) are allowed as long as they remain on a platform (board) that contains them. Floating arm trebuchets are allowed but must be fired in the same manner as other trebuchets. The trebuchet **cannot** be fired by manually dropping weight onto the throwing arm. Trebuchets can only be fired by releasing the throwing arm or sling. No other part of the trebuchet may be touched during the launch process.
14. Each trebuchet must have a target (**this will be provided**). This will be one of the targets the other team will shoot at so the operator must not obstruct the target opening. If an operator intentionally or consistently obstructs the target, the trebuchet will be disqualified and removed from the playing field.
15. The projectiles will be regulation *soft* squash balls of a **variety of sizes and weights**. Operators must compensate for differences between projectiles. 10 balls will be provided for each trebuchet to use while in competition. The squash balls are to be returned at the end of each match for use in subsequent matches.
16. A qualification check sheet will be provided as part of the rules, and separately on the competition website. This sheet is for teams to check if their trebuchet is in compliance prior to the competition. A separate sheet must be completed for each trebuchet that a team plans to use in competition and brought to registration for verification by a judge. Check sheets must be completed prior to the start of the team's first match.
17. Qualification at check-in does not guarantee continued qualification. Trebuchets are subject to random checks at any time. This is done to prevent illegal modifications after check-in and to catch possible oversights by the volunteer qualifier. Failure to catch violations at check-in does not take away our right to rectify the mistake later.

18. If you suspect an opponent of using illegal trebuchets, you are allowed to make a challenge. However, challenges without merit will not be tolerated. A failed challenge will result in a warning. A second failed challenge will result in disqualification of the challenging team. Challenges can be made at any time before, during, and after the match, but not after the next match begins. Challenges are more efficiently addressed at the conclusion of a match. If the suspect team loses the match, then the challenge is irrelevant and the competition can continue without interruption.
19. If any trebuchet fails a challenge, the opposing team in the challenged match will be declared the winner.
20. The decision of the qualification judge may be appealed to the director or an appointee of the director.
21. Expected throws are in the range of 30-45 feet. If your trebuchet cannot consistently hurl projectiles this distance, you will likely not do well in the competition.

Teams

1. A team consists of 3 positions: a captain, an assistant, and up to 3 trebuchets, with one operator per trebuchet. The team advisors may fill the roles of captain and assistant only.
2. The team is defined by the group of trebuchets. A team may have no more than 5 members. Members not operating trebuchets may retrieve ammunition on their half of the field only.
3. Teams of up to 3 trebuchets (one per trebuchet operator, and only one operator per trebuchet) will compete in a head-to-head competition.
4. Each trebuchet must be operated by only one person. The operator **may not** move away from the trebuchet. If the trebuchet is left unattended, it is considered 'destroyed by sabotage' and must be removed from the playing field.
5. The captain and assistant may not enter the playing field during competition. They may give direction from outside the playing field and may recover ammunition that leaves the playing field (on their own half).
6. Each operator on the playing field must wear safety goggles or glasses that will protect the eye. **Safety goggles will be provided the day of the competition** but you are encouraged to bring your own if you have them. Trebuchets may not be operated by players without proper eye protection.

Matches

1. Competitions will last for 5 minutes. There will be 5 minutes between each match for teams to get set for the next match. Match times may be increased depending on the number of participating teams.
2. Teams will not be allowed to compete if a qualification checklist has not been completed prior to the scheduled match. If your team is not qualified when the match is ready to begin, you will forfeit.
3. Trebuchets will fire at will when the match begins.

4. Trebuchets that are not placed for competition prior to the start of a match may not enter the playing field during the match.
5. Opposing teams may have a different number of trebuchets. If you only bring one trebuchet and your opponent has 3, they are allowed to use all 3 against your one.
6. Each trebuchet will be provided with 10 projectiles during a single competition. Trebuchets on the same team may share projectiles. If a trebuchet is knocked out, any remaining ammunition may be transferred to the remaining trebuchet.
7. Friendly fire may destroy a trebuchet if it scores the trebuchet's target.
8. Team members are not permitted to block targets. If the judge feels that you acted as an obstruction, the target will be considered scored.
9. Trebuchets may not screen one another, or be positioned to screen a trebuchet's target or field target. Guilty trebuchets will be considered scored and removed from the field.
10. Hoarding of ammunition is not permitted. If the judge feels a team is hoarding ammunition, the opposing team will be declared the winner by default.
11. Targets may **not** be scored by a projectile bouncing into the target (i.e. a projectile is 'dead' once it touches the ground), but **scoring projectiles that bounce OUT of a target are considered scored.**
12. The projectile **must hit the bottom** of a free scoring bucket to count. Swirling around and going out does **not** count.
13. If a projectile *enters* a trebuchet scoring target and knocks the target over, the target is considered scored even if the projectile falls out. However, if the projectile hits the *outside* of the target and knocks it over, this is **not** considered as a score. The target must be set back up as quickly as possible to allow additional attempts by the opposing team.
14. If a trebuchet is destroyed, the operator must leave the playing field immediately with their trebuchet.
15. You are free to return fire with the enemy's non-scoring projectiles. **DO NOT** remove any scored projectiles from the scored target.
16. The competition field will be a rectangle 20 feet wide and 50 feet long. Opposing teams will occupy 20' x 20' battle regions at either end of the competition field. The 10' x 20' region between the two battle regions is considered 'no man's land'. No part of a trebuchet may extend into this area. The playing field will be marked.
17. Teams may position their trebuchets anywhere within their battle region. However, once placed, they cannot be moved forwards, backwards, nor sideways during competition. Trebuchets **may be rotated** to acquire targets.
18. Each team will have one kill target that may be placed anywhere in their battle region. If your team scores this target in the opponents field, your team wins by default. The kill target may not be moved or blocked during competition. The kill target will be ring stand with a 4-inch ring. The height of the kill target must be between 24" and 36" from the playing surface.
19. The height and location of the kill target may not change during a battle, but may be adjusted between rounds.
20. The trebuchet targets must be placed immediately in front of the trebuchet and must not be moved during the battle.

21. If your team destroys all trebuchets of the opposing team, your team wins by default.
22. Each team will have two multiple-scoring field targets (targets that can be scored multiple times) that are stationary in their battle region. These targets may not be moved or blocked during competition. Field targets will be small plastic trash cans or buckets. Actual targets and sizes may change from match to match, but within a given match both teams will have the same size targets.
23. Point values for scoring targets:
 - Trebuchet target – 100 points
 - Field scoring target (large) – 15 points
 - Kill target – Automatic win
24. Teams are responsible for gathering spent ammunition at the end of each round. At the conclusion of a round, teams will have 3 minutes to gather any remaining spent ammunition and return them to their storage bin. 5 points will be deducted for each missing projectile at the end of the 3 minutes.
25. If no team wins by means of the kill target, the team with the highest point total at the end of the round (and any penalties) will be declared the winner. In the event of a tie during regulation, extended time will be given for a sudden-death match. In this match, the first team to score **any points** is declared the winner. In this situation, both teams will move to the sudden death area so that the next round may begin setting up. Four buckets will be placed midway between opposing teams. The first team to score in any of the four targets is the winner.
26. Operators may adjust or reattach the sling during competition. The sling does not fall under the design rule about components of the trebuchet becoming disconnected. Other minor repairs may be allowed at the judge's discretion.
27. Each field will have a field marshal who is familiar with the competition and the rules. They are there to support the judges and handle discrepancies. All field marshal decisions are final. Under no circumstances shall a photo or video recording of the event be used to reverse a decision.
28. 'Byes' may be necessary. If so, preference will be given to schools with the fewest number of teams and teams that register the earliest.

Miscellaneous

1. Just like in previous years, we are going to run a double-elimination tournament. **Keep in mind that this will mean possibly long wait times between matches. Unfortunately there is no way for us to avoid this, so please be patient.** We can eliminate wait times more by going to a single elimination format, but we would prefer teams to get at least two matches. The format may change to allow for more matches depending on the number of registered teams. (For example, there may be a round-robin setup with the top two teams from each group advancing to a single elimination round.) The final format will be announced a day or two prior to the competition when the number of competing teams is finalized.
2. To help fill the waiting void between matches, we will again be inviting representatives from different college programs and/or local businesses to have informational tables at the contest. **Please encourage your students to visit these tables.** This is a great opportunity for students to find out more information about schools and programs they might be interested in. To motivate table visits, anyone who visits 5 or more tables and gets the representatives verification will be entered into a drawing for an iPad. If we have 10 or more tables, then a student's name will be entered once for every 5 tables they visit. (e.g. 10 tables = two entries).

3. Trebuchets 'destroyed' in preceding matches are considered rebuilt for subsequent matches.
4. Expect to be ready to compete when you arrive. There is no practice time or place available.
5. Teams are responsible for being at the playing field when they are scheduled to compete. We do not have the time or resources to track you down. Any team not ready to compete at their scheduled time will forfeit the match.
6. The schedule of the tournament will be sent out about 1 week prior to the competition. A final list of competing teams will be due from each school two weeks prior to the competition. No team may be added after this date. The schedule may change up to the day of the tournament. Upon any revision, new schedules will be sent out to team advisors immediately. Registration is to be done individually through the trebuchet website. Be sure each team member inputs the same team name.

www.lc.edu/trebuchet

7. Please note that tournament rules may change if necessary. This will not be done frivolously. However, this means that if the director says something, it is a rule because he/she says so.
8. There is no higher authority than the tournament director. There is no avenue for objection if you disagree with the director.
9. All field marshals' decisions are final. Under no circumstances shall a photo or video recording of the event be used to reverse a decision.
10. Please keep in mind that this is a continually growing competition. Your patience and understanding will be much appreciated. Our priority is to make this a fun learning experience for the teams. Constructive feedback is always appreciated.

Some competition tips

- Pick trebuchet targets based on strategic value and opportunity. If you can acquire a scoring target quickly, it may be more to your advantage to focus on it rather than the kill target if your opponent is not close to hitting your kill target.
- Concentrate on more urgent targets first. For instance, if the opposing team has an accurate trebuchet, it may be better to focus on that trebuchet's target rather than the opponent's kill target.
- If your trebuchet can fire a long range, then stay back. Use your long range to stay protected from the opposing team.
- The extent of an opponent's threat is based on their accuracy, rate of fire, and number of trebuchets. Using less than the maximum number of allowed trebuchets can put your team at a disadvantage.
- Sling pouches and the sling release pin can make a huge difference. Research some different designs to find what works for you.

Trebuchet Exploration Report Competition

The Lewis & Clark Trebuchet Competition culminates on competition day, but the real learning takes place during the research and experimentation of the trebuchets for competition. Each team should submit a technical report that summarizes their efforts in preparation for the competition. **Ideally the report will detail the design and testing process of the team. Judges will be looking for mistakes/failures and lessons learned. That is, we want to see examples of “We tried this, these were the results, and here is what we did to improve the design.”** Background research is often overlooked. Teams should be sure to include a summary of lessons learned from research. The following criteria will be used to judge the reports:

10%	Report Aesthetics	A technical report needs to be informative and readable. Style issues include report formatting, spacing, grammar, use of figures and graphics, and conciseness.
15%	Background	This refers to how well the team researched and explains background material related to trebuchet construction. This may include historical material, construction approaches, material properties, or other related items.
30%	Design and Construction	This refers to how well the team recounts their trebuchet design efforts and construction experience.
30%	Experimental Design and Analysis	This refers to how well the teams approach and document their trebuchet testing. Discussions may include the objectives of the testing, factors taken into consideration, control of lurking variables, planning and execution of testing, and interpretation of results.
10%	Budget	This refers to how well the team tracks its finances. A planned budget of time, material, and money should be included, as well as the actual final amounts.
5%	Summary and Conclusion	This refers to the team’s ability to recount their overall experience, design and construction efforts, and lessons learned.

Reports must be submitted electronically by email at least 1 week prior to the competition! Handwritten reports can be scanned and emailed. All submissions become the property of LCCC. Submissions should be emailed to trebuchet@lc.edu.

Some sample reports are available on the resource page of the trebuchet website.

Awards

This year's competition has \$1700 in cash prizes in addition to the iPad drawing. There will also be drawings for several \$25 gift cards, and first place teams in each category will receive a trophy.

Awards will be given as noted below:

Trebuchet Battle Competition

First Place: \$450 (total for team)

Second Place: \$250 (total for team)

Third Place: \$150 (total for team)

Exploration Report

First Place: \$450 (total for team)

Second Place: \$250 (total for team)

Third Place: \$150 (total for team)

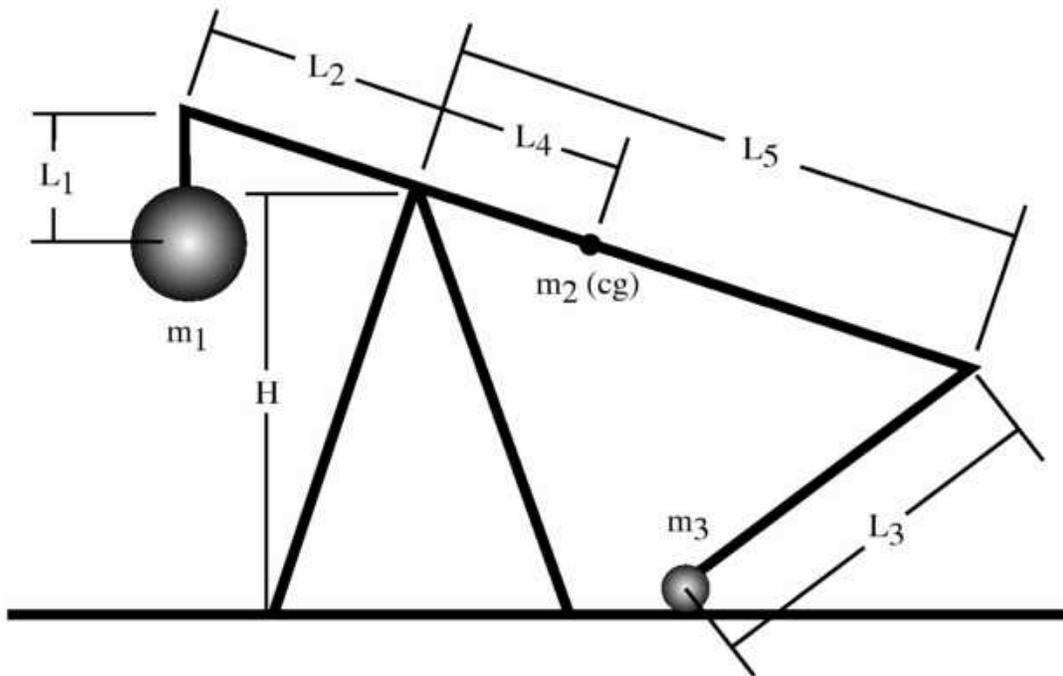
iPad Drawing

For every 5 unique information tables a student visits, their name will be entered into a drawing for a new iPad. Signature cards will be given out at check-in and must be returned by the end of the competition for consideration in the drawing.

[e.g. 5 different tables = 1 entry, 10 different tables = 2 entries, etc.]

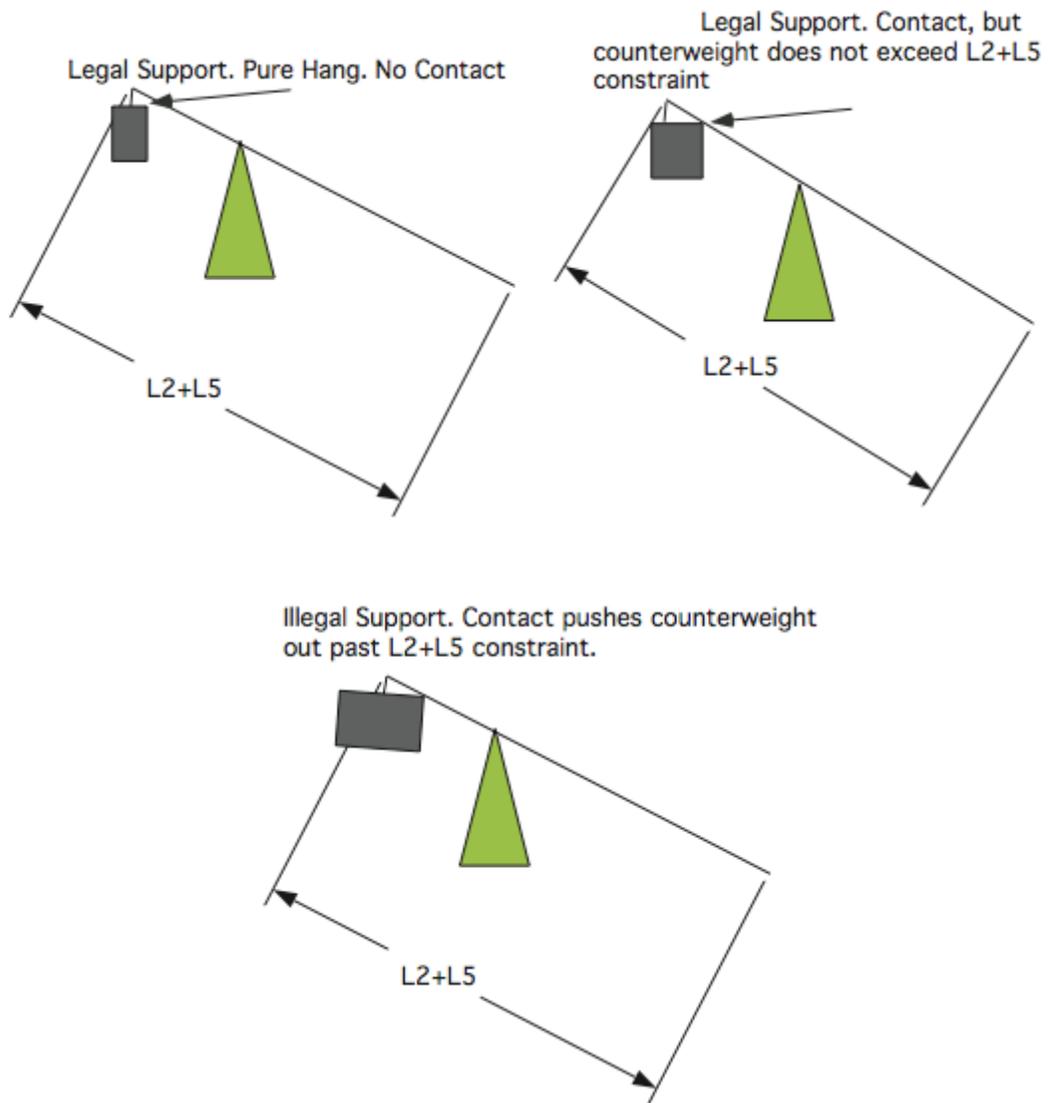
Trebuchet Figure for the year 2019

Figure 1



Counterweights for the year 2019

Figure 2



Special thanks to Professor Joseph Slater at Wright State University for allowing us to model our competition after the Wright State University Trebuchet Contest.

Trebuchet Qualification Checklist

Trebuchet Number: _____

Qualification Requirement	Adv. Check	Judge Check
Trebuchets, and/or their platforms, must have soft feet (felt or cloth). No rubber or wooden feet are allowed to touch the ground.		
Recoiling trebuchets (with wheels) must be on a platform (board) to stop rolling motion.		
Is the trebuchet safe? No loose parts are allowed that will break free.		
The trebuchet shall consistently throw a soft squash ball a horizontal distance of at least 30 feet before ground impact to qualify.		
No catapults or catapult/trebuchet hybrids are allowed. No energy can be stored in deformation of components. There are no springs, rubber bands, flexible arms, etc.		
No pulleys or ball bearings can be used.		
The counterweight must be attached, not looped over, the end of the arm (or close to the end). The top pivoting lever must be greater than 1/4" thick.		
The counterweight is (up to) <i>5 unopened cans of soda</i> .		
The counterweight must be either: a) dangling throughout the entire throwing motion (makes no contact with other parts of the trebuchet lever arm), OR b) must be rigidly attached to the arm (i.e. doesn't slide, wiggle, etc.)		
The counterweight must be attached so that it does not come free on its own.		
The top pivoting lever (length L2 + L5 on the example figure) must not be able to lift off the ground in the cocked position until the counterweight is attached. Any fastening devices to be used in the competition will be included as part of the arm during testing for balance.		
The top pivoting lever must be balanced toward the projectile end (see L5 end) throughout the entire range of motion.		
The top pivoting lever (length L2 + L5) must not be longer than 3 feet. This length includes the sling hook.		
The top pivoting lever (length L2 + L5) must not be collapsible.		
The height of the center of the pivot point (H) is less than or equal to 2 feet 2 inches.		
The judge has dated (year only) and signed trebuchet.	XXXXXXX	

Check all that apply

Failed 1st
Check _____

Failed 2nd
Check _____

Other (put note
on back) _____

Qualification Judge's Signature