



## Cardboard Boat Competition

**Level:** Middle and High School (6<sup>th</sup> – 12<sup>th</sup> grades)

**Type of Contest:** Team

**Composition of Teams:** 2-4 students per team; 5 students max

**Overview:** Students will work as an engineering design team with the goal of building a cardboard boat that travels the length or width of a competition ready pool in the least amount of time. The team is responsible for submitting an engineering lab book that documents the engineering design process. In addition, the students are responsible for building a competition ready boat.

**Materials:** Only the following materials are permissible:

- Untreated cardboard
- Water-based polyurethane
- Any kind of tape (duct tape works best)
- NOTE: Tape can only be used to cover joint areas in any direction and amount; tape cannot be used to fully cover any surface area on the boat (i.e., side, bottom, inside, etc.)

### Rules:

1. Boats Size: Maximum boat size is **5 feet wide, 7 feet long**, and a minimum of **1 foot high**. Rafts will automatically be disqualified. The use of pontoons will also be scrutinized, as traditional pontoon boats (boat load rests on pontoons and not on the body of the boat on the water) will also be disqualified.
2. Boats submitted to the competition must be competition ready. They must be dry and pre-constructed in advance of the event.
3. Teams may use polyurethane to coat their boats as deemed appropriate. The MESA center may provide a provision based upon the number of teams from one school participating in this competition.
4. Boats that appear to be wet due to recent polyurethane coatings or flimsy with loose parts will be disqualified. NOTE: It takes water-based polyurethane about 3 days to dry, so apply the last coat of polyurethane at least 3 days before the event.
5. Boats may not be painted or marked with anything that can pollute the pool. Painted or marked boats will lead to disqualification.

6. Two students must enter and ride the boat during the races. The students who constructed the cardboard boat must be the same students who will be participating in the race.
7. The boat and lab book must be an original representation of the team's work.

### **Judging:**

1. The competition will be judged in two parts: 1) the boat's performance in the pool, 2) the lab book, 3) originality and ingenuity of design.
2. Two to three boats will participate in each heat. Multiple timers will be assigned to each boat, and the times will be averaged.
3. Each boat will have one opportunity to race.
4. Each team will have 1 minute to stabilize their boat in the water.
5. Once the team members of all teams are safely secured in the boats or the stabilization time period has elapsed, the race will begin on the following command: "Ready, Set, Go!" or something similar.
6. The competing boats will be lined via the fronts of the boats to ensure a fair start. NOTE: the starting location will be the same in all heats.
7. Timing (per boat) will cease once the lead person in each boat crosses the finish line OR boat is deemed incapable of finishing (eg. capsizing, flipping over, etc.).
8. The finish line will be marked by a cone or some other object along the side of the pool OR will be the opposite wall of the pool (depending on pool dimensions and constraints.)
9. The distance between the starting location, where all lead bodies in the boat are lined up, and the finish line will be the same for all teams.
10. No points will be awarded to boats that capsize, sink, or fail to travel the entire length of the pool.
11. Scores for the performance will equal the ratio of each device's performance relative to the winning device's performance on that task. Those scores are weighted according to the maximum points for performance which is 50 points.
12. Each team must submit an engineering lab book that documents the engineering design process. The lab book is worth 25 points. **See Year End Engineering Lab Book Instructions and Rubric.**
13. Ingenuity of design will also be judged via a rubric at the discretion of the judges. The design score is worth 25 points **See Design and Ingenuity Rubric on following page.**
14. The performance, lab book and design scores will be added to determine winners; the highest possible score is 100.

**Awards:** Awards will be given for 1st, 2nd, and 3rd place teams in each competition level (Middle School: 6th- 8th grade students, High School: 9th – 12th grade students)

**NOTE:** Many students sometimes struggle to understand what exactly constitutes a boat. For this competition, a boat is defined as a "vessel that passengers enter into that creates buoyancy through the displacement of water." Compared to a traditional boat, rafts and pontoons function differently and do not displace nearly as much water. The rules (to build a boat) are based on this idea.

# MESA CARDBOARD BOATS: DESIGN AND INGENUITY RUBRIC

Student Names:

School:

Level (Middle/High School):

<b>Criteria</b>	Exceptional (5 pts)	Excellent/Good (4 pts)	Satisfactory/Meets Criteria (3 pts)	Fair (2 pts)	Poor (1 pt)	<b>Totals</b>
Creativity: How creatively did team use materials/items						
Design: Device was well conceived; functional and effective						
Ingenuity: Design was ingenious, different from what would be considered "normal" or expected						
Quality/Craftsmanship: Device was built well, showing capable craftsmanship and attention to detail						
Aesthetics: In judge's opinion, it is a great looking project, aesthetically pleasing to the eye						

**GRAND TOTAL**

*(25 points possible)*