

## OVERVIEW

Applying leadership and 21<sup>st</sup> century skill, participants design and build a mechanical device to solve the problem statement for the identified theme. Through device functionality and documentation, team members demonstrate their knowledge of mechanical engineering and the application of their solution. The challenge is to design and make a working catapult, within the specified guidelines. The current year's problem statement will be posted on the [TSA website](#) under *Themes & Problems*.

## ELIGIBILITY

One (1) team of two (2) individuals per chapter may participate.

## TIME LIMITS

- A. Catapults must be started and completed during the current school year.
- B. The catapult and portfolio must be checked in at the time and place stated in the conference program. At check-in, one team member will sign up for a time slot to return and evaluate the solution.

## PRELIMINARY ROUND

- A. Three (3) minutes of practice time.
- B. Two (2) minutes to score shooting eight (8) cornhole bags.

## SEMIFINAL ROUND

- A. One (1) minute of warm-up before each round.
- B. One (1) minute shootout of four (4) cornhole bags.

## ATTIRE

TSA competition attire is required.

## PROCEDURE

### PRE-CONFERENCE

- A. Participants review the TSA Honor Statement for Competitive Events found in the General Rules and listed in the individual competitive event rules.
- B. Teams must identify and understand the use of subsystems with a larger system

- C. Teams must research and identify an engineering design progress that influenced the design of the catapult.
- D. Participants review and implement the annual problem statement posted on the [TSA website](#) under *Themes & Problems*.

## PRELIMINARY ROUND

- A. Participants check in their entries at the time and place stated in the conference program:
  1. One (1) Catapult
  2. Documentation Portfolio
- B. Catapults are inspected by evaluators to determine among other things, safety. Catapults that meet all compliance regulations will be approved for the performance stage of the event. Any unsafe devices will be disqualified. (Unsafe catapults include those with parts that detach during operation or those with a dangerous rotation or throwing motion, either of which could cause harm or damage.) Judges will make a final determination about the operational safety of a catapult.
- C. If an entry's catapult is approved for the performance stage of the event and the team qualifies for the semifinal round, the entry's design portfolio will be evaluated.
- D. A time sheet will be provided for sign-up at check-in.
- E. Both students must be present for the performance stage of the event.
- F. Teams will receive eight (8) cornhole bags to score points in a two (2)-minute scoring stage. Cornhole bags are square bags that measure 6" x 6" (15.24 cm x 15.24 cm) with a thickness between 1.125" - 1.5" (28.5-38.1 mm). The weight of cornhole bags is regulated at between 14-16.5 oz (440-470 g).
- G. Students must bring and wear safety glasses for this stage of the event.
- H. One (1) team member will use a tape measure for measuring and calibrating the distance from the front of the catapult to the front of the cornhole board. The tape measure will be provided by the team.
- I. The team will be given three (3) minutes of practice to adjust catapult for accuracy to the required distance.

- J. Teams will position their catapult on the “firing range” and wait for the command to “FIRE”.
- K. When teams receive their bags and the fire command is given, they will have two (2) minutes to launch up to eight (8) bags to accumulate as many points as possible on/in the cornhole board. Each team must cease firing at two (2) minutes. No shots taken after time has been called will count. The two (2)-minute timer begins with the “FIRE” command.
- L. Teams are allowed to repair a catapult malfunction, but the timer does not pause.
- M. Each team must cease firing at two (2) minutes. No shots taken after time has been called will count. A shot fired before the two (2) minutes and lands after the two (2) minutes will still count. The amount of time left is recorded if teams finish before the two (2) minute times.
- N. Scoring is as follows: in the hole, five (5) points; on the board, three (3) points; off the board in the marked area, one (1) point. A bag on the line will count as “in the marked area.” (A vertical plane extends upward from the outside of the line and counts a one [1] point).
- O. Scores are not tabulated until the two (2)-minute timer has expired. Cornhole bags are scored where they rest at the end of two (2) minutes or the team declares they are finished with their turn.
- P. Ties will be broken as follows.
  - 1. The team with the highest score and the fewest number of bags scored.
  - 2. The team with the greatest time remaining.
- Q. Team members must collect all eight (8) cornhole bags once judges complete recording points and before leaving the event area and returning them to the firing range.
- R. Preliminary ranking will be determined from points earned.
- S. Lack of catapult compliance may result in disqualification.

## REGULATIONS AND REQUIREMENTS

Students will work to develop their leadership and 21<sup>st</sup> century skills in the process of preparing for and participating in this TSA competitive event. The development and application of those skills must be evident in their submission, demonstration, and/or communication pertaining to the entry.

### PRELIMINARY ROUND

- A. Documentation portfolio is required and must be secured in a [clear front report cover](#) with the following single-sided, 8½" x 11" pages, in this order:
  1. Title Page with the event title, the conference city and state, the year, and the team/chapter ID number; one (1) page
  2. Table of contents; pages as necessary
  3. Identification and explanation of the engineering design process used to produce the catapult; maximum six (6) pages
  4. Bill of materials; one (1) page
  5. Design sketches and detailed drawings; maximum two (2) pages
  6. References and resources; one (1) page
  7. Work Log (see 2026 & 2027 Forms Appendix); pages as needed
- B. Participants must bring and wear safety goggles during the performance stage of the event.
- C. Teams must provide their own tape measure (at least 25' length).
- D. The catapult may be no larger than 24" tall x 24" long x 18" wide while in the loaded position. The launch arm may extend beyond the size parameters of the catapult only while launching.
- E. The base of the catapult should accommodate the provided ballast. The ballast will be two (2) 25lbs Olympic plate weights, provided by TSA on site.
- F. The catapult must operate completely within the given area; the launch arm may extend beyond the front of the catapult only while launching.
- G. The catapult may have any type of spring mechanism to power the arm, but all parts must be contained within the 24" tall x 24" long x 18" wide maximum footprint prior to launch.

- H. The catapult's total weight must not exceed fifteen (15) pounds.
- I. All parts of the catapult must initiate behind the launch line, but parts may extend over the line during and after the last launch.
- J. The catapult cannot have wheels.
- K. The catapult must be made entirely from PVC pipe, with the exception of the launch mechanism, firing mechanism, fasteners, and safety items. These items may be wood or metal and must be constructed in a safe way, so as not to damage the device, the testing area, or cause harm to others.
- L. The following may not be used:
  - 1. Glass
  - 2. Flammable, corrosive, or explosive materials
  - 3. Compounds that produce odors or gases
- M. The catapult must have at least a five (5)-foot pull cord to launch from a safe distance.
- N. When the catapult is on display or not in the performance stage, it must be fully disabled and unable to be readied for firing.

### SEMIFINAL ROUND

- A. The portfolios of the twelve (12) semifinalist teams are independently reviewed by judges, with neither students or advisors present.
- B. The top twelve (12) catapults report to the firing range at the posted time.
- C. The top twelve (12) compete in a head-to-head single elimination bracket to earn point for the finals.
- D. Teams will face off head-to-head in a one (1)-minute shootout of four (4) bags on their designated cornhole board. Teams will receive a one (1)-minute warm-up before each round.
- E. The team with the highest score or tie breaker will advance to the next round of the bracket.
- F. Semifinal ties are broken as follows:
  - 1. The team with the highest score and fewest number of bags scored.
  - 2. The team with the shortest time recorded to score the most points.

- 3. Sudden death shootout (one [1] launch each with the higher score for the launch determining the team to advance – repeating as necessary).
- G. Following the completion of the bracket, participants pick up their entries from the display area at the time and place stated in the conference program.
- H. Preliminary and portfolio scores are combined with bracket points to determine the final standings.
- I. Ten (10) finalists are announced during the conference award ceremony.

### EVALUATION

#### PRELIMINARY ROUND

- A. Preliminary scores

#### SEMIFINAL ROUND

- A. Portfolio
- B. Score from head-to-head bracket

Refer to the official rating form for more information.

### TSA HONOR STATEMENT

All work must be created and completed by individual competitors or teams. Plagiarism, the use of Generative Artificial Intelligence (GenAI) software, copyright violation, cheating, and falsification of information are prohibited. Participants may NOT use any generative artificial intelligence (GenAI) tools (e.g. ChatGPT, Google Gemini, GitHub Copilot, etc.). Any attempt to gain an unfair advantage will not be tolerated. Competitors at any level of TSA competition understand and agree to abide by the TSA Honor Statement.

If it is determined that a student violated the TSA Honor Statement, a rules violation of twenty percent (20%) will be incurred.

### STEM INTEGRATION

This event has connections to the STEM areas of Science, Technology, Engineering, and Mathematics.

## LEADERSHIP AND 21<sup>ST</sup> CENTURY SKILLS

This event provides opportunity for students to build and develop leadership and 21<sup>st</sup> century skills including but not limited to – Communication, Collaboration/Social Skills, Initiative, Problem Solving/Risk Taking, Critical Thinking, Perseverance/Grit, Creativity, Relationship Building/Teamwork, Dependability/Integrity, and Flexibility/Adaptability

## CAREERS RELATED TO THIS EVENT

This competition has connections to one (1) or more of the careers below:

- Engineer
- Multimedia designer
- Product designer
- Small business owner

Participant/Team ID# \_\_\_\_\_

# MECHANICAL ENGINEERING

## 2026 & 2027 OFFICIAL RATING FORM

### MIDDLE SCHOOL

Judges: Using minimal (1-4 points), adequate (5-8 points), or exemplary (9-10 points) performance levels as a guideline in the rating form, record the scores earned for the event criteria in the column spaces to the right. The X1 or X2 notation in the criteria column is a multiplier factor for determining the points earned. (Example: an "adequate" score of 7 for an X1 criterion = 7 points; an "adequate" score of 7 for an X2 criterion = 14 points.) A score of zero (0) is acceptable if the minimal performance for any criterion is not met.

#### Go/No Go Specifications

- Before judging the entry, ensure that the items below are present; indicate presence with a check mark in the box.
- If an item is missing, leave the box next to the item blank and place a check mark in the box labeled ENTRY NOT EVALUATED.
- If a check mark is placed in the ENTRY NOT EVALUATED box, the entry is not to be judged.

Entry passes compliance checklist  
 ENTRY NOT EVALUATED

PRELIMINARY ROUND – SCORING (40 points)							
1st: 40 Points	2nd: 39 Points	3rd: 38 Points	4th: 37 Points	5th: 36 Points	6th: 35 Points	7th: 34 Points	
8th: 33 Points	9th: 32 Points	10th: 31 Points	11th: 30 Points	12th: 29 Points	13th or greater: 28 Points		
PRELIMINARY ROUND – SCORING SUBTOTAL (40 points)							
Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.							
Indicate the rule violated: _____							

#### PRELIMINARY SUBTOTAL (40 points)

SEMIFINAL – DOCUMENTATION PORTFOLIO (60 points)				Record scores in the column spaces below.
CRITERIA	Minimal performance	Adequate performance	Exemplary performance	
	1-4 points	5-8 points	9-10 points	
Portfolio (X1)	Portfolio is unorganized and/or is missing three (3) or more components.	Portfolio is missing one (1) or two (2) components and/or is loosely organized.	Portfolio has all required components in order and is well organized.	
Engineering Design Process (X1)	The description of the engineering design process is unclear, unconvincing, and lacks project details.	The description of the engineering design process includes some project details and explanation of steps in the design process.	The description of the engineering design process includes a full explanation of each step in the process; the description is defined, and detailed	
Bill of Materials (X1)	Bill of materials is included, but more than one (1) material is missing.	Bill of materials is included with one (1) material missing; List is generally organized.	Bill of materials is included; it includes all materials, components, quantities, and is well organized.	



SEMIFINAL – DOCUMENTATION PORTFOLIO (60 points) – continued			
<b>Design Sketches and Drawings (X1)</b>	Only one (1) drawing/sketch of the model is included with little to no labeling.	Two (2) or more drawings/sketches of the model are included and are labeled.	Detailed drawings/sketches of the entire device/model are provided and appropriately labeled
<b>Work Log (X1)</b>	The Work Log lacks major elements of the project.	The Work Log is somewhat complete, and generally reflects the time and work necessary for the project	The Work Log completely and accurately reflects the time and work necessary for the projects.
<b>References and Resources (X1)</b>	There is little to no effort to provide references and resources.	References and resources are included and are somewhat credible.	There is clear evidence of the appropriate use of applicable references and resources.
<b>SEMIFINAL – DOCUMENTATION PORTFOLIO SUBTOTAL (60 points)</b>			

SEMIFINAL ROUND – HEAD-TO-HEAD SCORE (20 points)					
1st: 20 Points	2nd: 18 Points	3rd: 16 Points	4th: 14 Points	5th-8th: 12 Points	9th-12th: 10 Points
<b>SEMIFINAL ROUND – HEAD-TO-HEAD SCORE SUBTOTAL (20 points)</b>					

Rules violations (a deduction of 20% of the total possible points for the above sections) must be initialed by the judge, coordinator, and manager of the event. Record the deduction in the space to the right.

Indicate the rule violated: \_\_\_\_\_

<b>SEMIFINAL SUBTOTAL (80 points)</b>	
_____	_____

To arrive at the <b>TOTAL</b> score, add any subtotals and subtract rules violation points, as necessary.	<b>TOTAL (120 points)</b>
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Comments:

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I certify these results to be true and accurate to the best of my knowledge.

**JUDGE**

Printed name: \_\_\_\_\_ Signature: \_\_\_\_\_

# CATAPULT SCORE SHEET

A shot attempt points may be modified if it is affected by a later shot

Participant/Team ID# \_\_\_\_\_

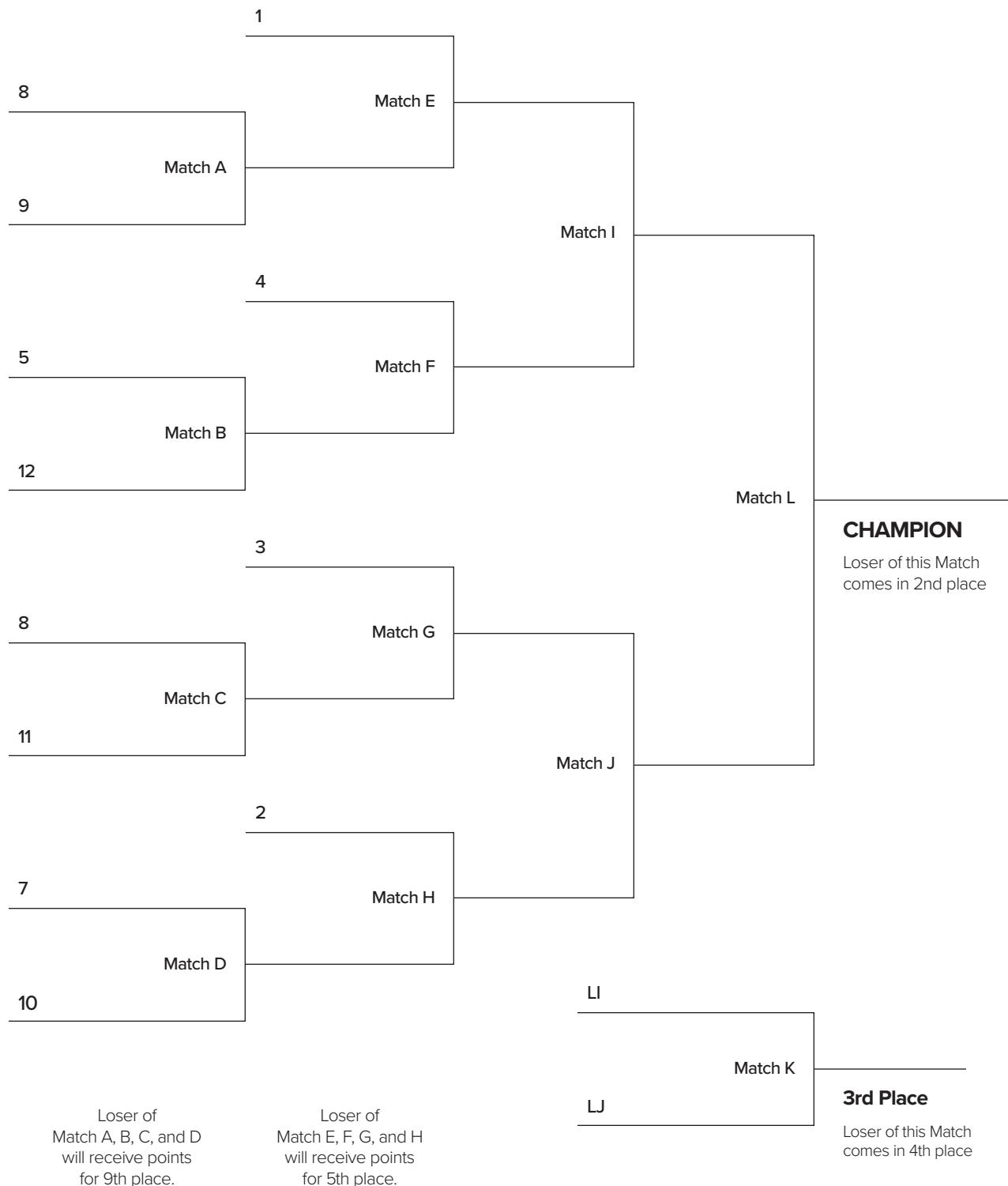
CATAPULT COMPLIANCE CHECKLIST		YES	NO
Does the team have safety goggles?			
Can the catapult be weighed down with two (2) Olympic weight plates (two [2] 25lbs)?			
Is the catapult within the size specifications?			
Is the catapult built with the correct materials?			
Does the catapult launch with a pull cord with at least five (5) feet of safety distance?			
Does the catapult have a safe launching mechanism?			
Is the catapult safe to operate?			
Please mark an "X" for each criteria. A "No" to any of the requirements will not advance.			

Shot Attempt #	Missed Shot 0 Points	Floor Zone 1 Point	On the Board 3 Points	In the Hole 5 Points	Modified Points
#1					
#2					
#3					
#4					
#5					
#6					
#7					
#8					

Total Points Scored:	
Time Remaining: (MM:SS)	

## HEAD-TO-HEAD BRACKET

Tournament Bracket Seeded 12 Team Field



# MECHANICAL ENGINEERING

## EVENT COORDINATOR INSTRUCTIONS

### PERSONNEL

- A. Event coordinator
- B. Judges:
  - 1. Preliminary round, two (2) or more
  - 2. Semifinal round, portfolio judging, two (2) or more
- C. Assistants
  - 1. One (1) per evaluation area
  - 2. One (1) to manage the evaluation area.
  - 3. One (1) to collect the score sheets from the judges and sort from highest to lowest totals.

### MATERIALS

- A. Coordinator's packet, containing:
  - 1. Event guidelines, one (1) copy for the coordinator and for each judge
  - 2. TSA Event Coordinator Report
  - 3. Stick-on labels for identifying entries (two [2] per team)
- B. Two (2) cornhole boards
- C. Four (4) sets (four [4] bags make a set) of different colored cornhole bags
- D. Four (4) 25lb. Olympic weight plates
- E. Tape (masking) to mark the firing range and 1' floor scoring area
- F. Two (2) tape measures for evaluators
- G. Bathroom weight scale
- H. Tables for displaying and evaluating catapults
- I. Tables and chairs for judges

### RESPONSIBILITIES

#### AT THE CONFERENCE

- A. Attend the mandatory event coordinator's meeting at the designated time and location.
- B. Report to the CRC room and check the contents of the coordinator's packet.

- C. Review the event guidelines and check to see that enough personnel have been scheduled.
- D. Tape down the necessary scoring lines needed for scoring and the launching distance for the two evaluation areas. Prepare the area to allow the head-to-head semifinal round to take place.
- E. At least one (1) hour before the event is to begin meet with judges and assistants to review time limits, procedures, regulations, evaluation, and all other details related to the event. If questions arise that cannot be answered, speak to the event manager before the event begins.
- F. Ensure the judges have access to the online judging system

### CHECK-IN

- A. Check in the entries at the time stated in the conference program.
- B. Check the entry for safety only.
- C. Late entries are considered on a case-by-case basis and only when the lateness is caused by events beyond the participant's control.
- D. In order to compete, participants must be on the entry list or must have approval of the CRC.
- E. Requirements for attire do NOT apply during check-in, only on the first day of the conference.
- F. Secure the entries in the designated area.
- G. Each entry must include the participant's identification number in the upper right-hand corner of the entry.

### PRELIMINARY ROUND

- A. Meet with judges to review time limits, procedures, and regulations. If questions arise that cannot be answered, speak to the event manager before the event begins.
- B. Conduct the evaluations of each entry. The judges will enter the scores.

## MECHANICAL ENGINEERING

C. Decisions about rules violations must be discussed and verified with the judges, event coordinator, and the CRC manager to determine either:

1. To deduct twenty percent (20%) of the total possible points in this round
2. To disqualify the entry

The event coordinator, judges, and CRC manager must initial either of these actions on the rating form.

D. Determine the top twelve (12) and post the semifinalist list.

### SEMIFINAL ROUND

- A. Judges independently assess the portfolio entries of the twelve (12) semifinalists and enter scores in the respective rubrics
- B. Report at the time and location provided in the conference program for the head-to-head challenge.
- C. Manage the head-to-head bracket to determine the bracket points.
- D. Enter the placement points from the head-to-head bracket.
- E. Manage security and student pick up of all entries at the assigned time and the removal of materials from the area.