

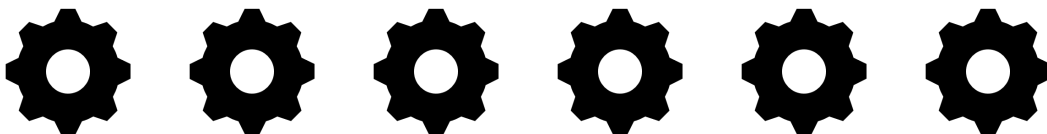


**PURDUE  
NATIONAL  
CHAIN  
REACTION  
COMPETITION**

---

**HANDBOOK - 2023**

---



## A Word from Us to You

---

On behalf of the Purdue Engineering Student Council (PESC), thank you for bringing your competitive drive and creative minds to the first annual Purdue National Chain Reaction Competition.

Months in the making, this year's event marks the remarkable collaboration of machine contest enthusiasts from across the country. Our mission has been to transform your ideas and input into a competition that best reflects your interests. This is first and foremost an event by students for students.

The goal of the event is to unite university teams from across the country to compete in a challenge in which students showcase their technical engineering, design, and mechanical skills along with the communication, creativity, and teamwork required to construct a wild, wacky, and entertaining machine.

Bringing together students, faculty, industry, and the community, the Purdue National Chain Reaction Competition hopes to foster an environment of imagination and innovation that sparks excitement for everyone involved.

Thank you again for your participation in our competition. This event would not be possible without you. We look forward to seeing what your team brings to the table and wish you the best of luck in the process.

Sincerely,

PESC



# Table of Contents

---

<b>A Word from Us to You</b>	<b>1</b>
<b>Machine and Competition Rules</b>	<b>3-7</b>
Rules I,II	3
Rules III,IV	4
Rules V,VI	5
Rule VII	6
Rules VIII,IX	7
<b>Scoring Rubrics</b>	<b>8-9</b>

## This Year's Challenge....

---

The goal of a chain reaction machine is to transform the completion of an ordinary task into an unnecessarily elaborate process that when performed, captivates everyone watching.

Making the everyday exciting and the mundane marvelous is the name of the game.

This year, in honor of the competition being held in the spring and in honor of the world cup, our task is to “**score a goal!**”



# Machine and Competition Rules

---

## I. Completion of Task

- A. The machine must successfully complete the task of scoring a goal such that a ball lies within a “goal” chosen by the team and contacts a form of “netting”. Incompletion of the task will result in an automatic zero in the “Final Step” category of the Objective scoring rubric and will likely lead to lower scores in other categories.

## II. Team Restrictions:

- A. Participants must be **18** years or older and be a full-time university student.
- B. There is no maximum number of team members. However, the initial registration fee only covers the first **10** members, and there will be a fee for each additional participant.
- C. During the run, a maximum of **4** “setters” will be allowed to adjust, fix, and reset the machine.

---

## III. Machine Specifications

- A. The maximum volume of the machine is **400 cubic feet**.
- B. Max length = **12 ft**.
- C. Max width = **12 ft**.
- D. Max height = **8 ft**.

E. Minimum of **10** attempted steps

---

#### IV. Machine Volume Calculations

- i) Teams will determine a base area for their machine and multiply that area by the largest height. This will be measured to the closest 2 inches.
    - (1) Use the machine's "resting" dimensions: Do not include moving parts that extend beyond the resting volume in the calculation. Identify these moving steps on the provided form.
    - (2) Example: If a swinging pendulum moves beyond the frame of a machine, measure the volume of the machine when it is not moving.
    - (3) All steps that move beyond the resting volume must stay within the 12ft x 12ft x 8ft region.
- 

#### V. Safety

- A. No fire or explosives are allowed.
- B. Flying objects, electronics, and other possible hazards must be identified and will be evaluated on a case-by-case basis.
  - i) A form to identify these steps will be provided.
- C. Machine and materials cannot harm anyone.
- D. Sabotage of others' machines will result in disqualification.

- E. No live animals.
  - F. No uncontrolled arcing electricity.
  - G. Decals of the profane, violent, or lewd nature are prohibited.
- 

## VI. Definitions

### A. Step - nonrepetitive transfer of energy

- i) Example: A transfer of energy between different object counts as multiple steps (for example between a marble and a domino), but a series of falling dominoes would count as one step.

### B. Intervention/Touch – each step that requires a touch will result in a 1 point deduction

- (1) Example: If an object is touched three times to reset it, only 1 point will be deducted.

- (2) A maximum of 15 points may be lost to touch infractions per run.

### C. Out of bounds - any object that leaves the 12x12 foot floor area or unintentionally leaves the resting volume space

- i) Resting volume space is the calculated machine volume. Objects may leave this space **IF** the step is identified on the provided form beforehand.

- (1) Example: A pendulum that swings outside of the “resting volume” is considered inbounds (if identified on the form) but a marble that flies off the machine is out of bounds and would incur a 1 point penalty.
- 

## VII. Provisions for Participants

- A. Each team will be provided with access to 1 (**3 prong**) outlet. Teams are expected to bring their own power strips and power cords.

- B. A table at each machine station
  - C. Room for personal belongings
  - D. Parking – includes trucks, cars, and trailers
- 

VIII. Timing Infractions

- A. Any team that goes beyond the total machine run time (2.5 minutes) will incur a 1-point deduction for every 10 seconds over the time limit. A maximum of 5 points may be deducted for timing infractions.
- 

IX. Judging

- A. Only the “Objective” section will be judged by people from our student organization (PESC). Industry judges will judge the “Technical” and “Style” categories.
  - B. There are no negative points.
  - C. The objective and technical sections will be judged for each run while the style section will only be judged once. The mean of the objective and technical sections and the single style score will determine the final round score.
  - D. The scoring is based on a **100**-point scale.
- 

X. Dates and Facilities

- A. The date of the Purdue National Chain Reaction Competition for 2023 is **Saturday, April 1<sup>st</sup>, 2023**.
- B. The event will be hosted in person in the **Purdue Armory**.



C. The event will simultaneously be broadcasted live on the Purdue National Chain Reaction Youtube account.

## Scoring Rubrics

Objective				
Category	Criteria	Scoring	Points	Max
Final Step	Did the machine successfully complete the final step without any interventions? If not, how many interventions?	Scored a goal = 15 # of interventions = ____		15
Steps	Did the machine attempt to complete 10 steps?	10 Steps Attempted = 5 # of missing steps = ____		5
Time	Did the team exceed run or reset time? Was the team under minimum time?	Team made time limit = 5 Seconds over/under = (____)/10		5
Bounds	Did any machine parts go out of bounds?	Machine stayed inbounds = 5 # of times out of bounds = ____		5
Total	Additional comments and total points:			30

Style				
Category	Criteria	Scoring	Points	Max
Explanation	How well did the presentation provide an overview for the machine?			10
Theatrics	Did the presentation engage the audience in a fun, exciting way?			10
Teamwork	How involved and coordinated were the team members? Did they collaborate?			10

Total	Additional comments and total points:			30
-------	---------------------------------------	--	--	----

<b>Technical</b>				
Category	Criteria	Scoring	Points	Max
Variety	How well did the machine incorporate different types of steps?			10
Creativity	How well did the machine utilize objects in unintended ways?			10
Visual Appeal	How easily could the story be followed? Were the steps visible and eye-catching?			10
Complexity	What is the level of complexity in the steps? How well did the machine use physics and engineering principles?			10
Total	Additional comments and total points:			40

<b>Total Scoring</b>				
<b>Round Scoring</b>	<b>Objective</b>	<b>Technical</b>	<b>Style</b>	<b>Total</b>
<b>Run 1</b>				
<b>Run 2</b>				

<b>Mean</b>				
-------------	--	--	--	--

## Registration

Registration for the competition will remain open through **February 11<sup>th</sup>, 2023 @11:59 pm.**

Registration is a two-part process:

1. Navigate to the Purdue National Chain Reaction webpage on the PESC website  
(<https://www.purdueesc.org/chain-reaction>)
2. Complete the Qualtrics Purdue National Chain Reaction competition survey under “Register Here” to provide team and contact information.
3. Apply for the PNCRC scholarship if your organization is in need of funding.

To register, please visit the PESC website under **this specific tab.**

## Forms

The Step Identification Form, Safety Hazards Form, and Volume Calculation Form must be completed and sent to **PurdueNationalChainReaction@gmail.com** by **Wednesday, March 29<sup>th</sup> 6:00 PM EST.**

Forms should be completed electronically and emailed in Word Doc or PDF form to **this email.** The subject for the email should be **Purdue National Chain Reaction Competition Forms - \*Team Name\*.**

## Tentative Schedule

9:00am – 12:00pm: Teams machine set-up

12:00pm – 1:00pm: Lunch provided for teams, opens to public

1:00pm – 1:30pm: Final machine preparation

1:30pm – 2:30pm: Round 1

2:30pm – 3:30pm: Round 2

4:00pm – 4:30pm: Awards

4:30pm - 6:30pm: Clean Up

9:00pm – 11:00pm – Free bowling at the Union