

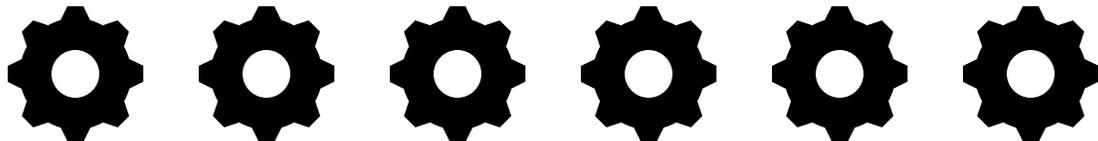


**PURDUE  
NATIONAL  
CHAIN  
REACTION  
COMPETITION**

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**HANDBOOK - 2020**

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## A Word from Us to You

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

The inaugural competition in 2019 was an immense success! We hosted four teams from around the country and are truly looking forward to expanding and improving the competition this year.

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,

Lauren Heiss



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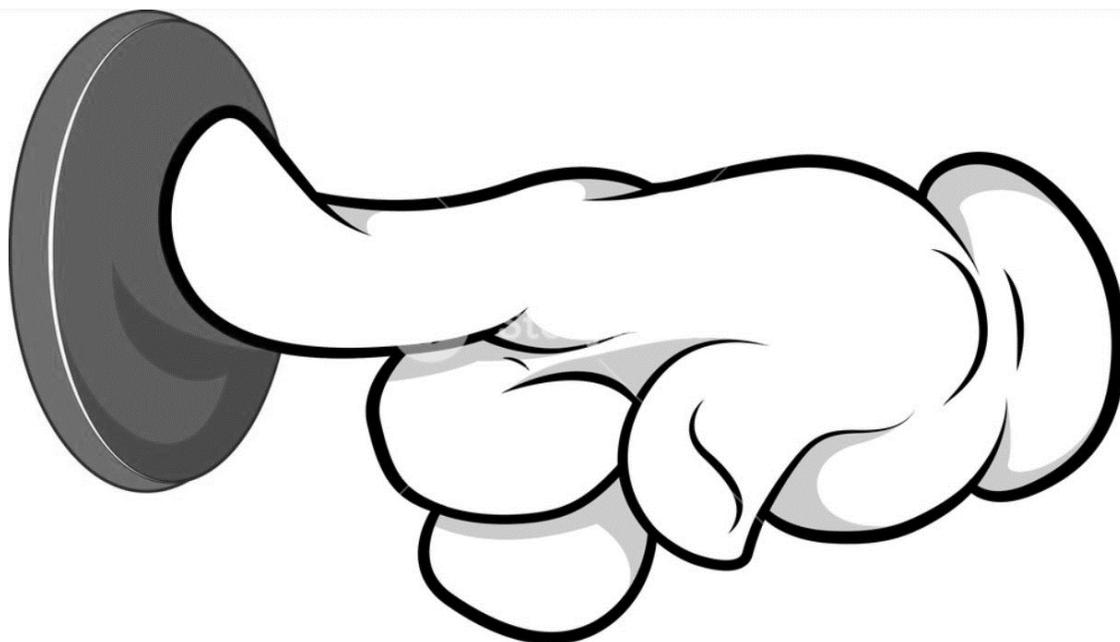
## This Year's Challenge....

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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.

**We are excited to announce that the Purdue National Chain Reaction Competition 2020's task is **ringing a doorbell!****



# Machine and Competition Rules

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## I. Completion of Task

- A. The machine must successfully complete the task of ringing a doorbell. Incompletion of the task will result in an automatic 0 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 competition, a maximum of **6** members will be allowed on the floor for the theatrical presentation.
- D. During the run, a maximum of **4** “setters” will be allowed to adjust, fix, and reset the machine.

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## III. Machine Specifications

- A. The maximum volume of the machine is **400 cubic feet**.
- B. Machine footprint must fit within **12ft by 12ft** floor area

C. Max height = **8 ft.**

D. Minimum of **30** attempted steps

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#### 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.

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#### 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.

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## VI. Definitions

### A. Step - nonrepetitive transfer of energy

- i) Example: A transfer of energy between different objects 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.
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## 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

E. Dolly

- i) A minimum of one dolly will be provided, but teams are encouraged to bring their own.
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VIII. Day of Competition

A. Pre-Competition Set-up

- i) Minimum of 4-5 hours on the day of the competition.
- ii) During lunch, the machine volume and number of steps will be checked. Therefore, machine set-up should be completed by this time. We will ask a team representative to walk us through the first 30 and final steps as well as safety hazards and steps that leave resting volume.

B. Theatrical Presentations

- i) The theatrical presentation will occur only during the **first round**, immediately before each team's first machine run.
- ii) There is **no minimum** time for the presentation.
- iii) The maximum presentation time is **2 minutes**.

C. Round Timing:

- i) Teams will have **20 minutes** immediately before the competition to make final adjustments.
- ii) In addition to the **20 minutes**, the first team will have a priming period of **4 minutes** to set any final steps before their run.
  - (1) In the first round, after the 4 minutes, or whenever the first team is ready, the first team will give the theatrical presentation and then immediately start their run
- iii) The second team's priming period will begin **2 minutes** into the first team's priming period and will include the time of the first team's run.
- iv) All following teams will begin their priming period when the machine two teams ahead of them starts their run.

(i) Example: The priming period for Team 3 begins when Team 1 starts their run. The priming period for Team 4 begins when Team 2 starts their run etc.

v) Teams are expected to be ready to run when it is their turn to ensure a smooth flow of competition.

vi) After their run, teams may only return objects that went out of bounds to their machine area but will not be allowed to reset their machine until the reset time begins.

D. Reset Timing:

i) After all the teams have completed their first run, a longer reset time of 15 minutes will begin for all teams. Following the **15-minute** reset period, the priming periods will occur in the format described above.

E. Min and Max Run Times

i) The minimum machine run time is **1 minute**.

ii) The maximum machine run time is **2.5 minutes**.

F. Timing infractions

i) Any team that goes beyond the set-up, presentation, reset, or run time will incur a 1-point deduction for every 10 seconds over the time limit. If the minimum machine run time is not reached, 1 point will be deducted for every 10 seconds below the time limit.

ii) A maximum of 5 points may be deducted for timing infractions per run.

G. There will be a minimum of **4-foot** aisles between team areas.

H. Order of teams: **Random**

I. There will be 2 rounds with 1 run per round.

J. While final scoring is completed, there may be an exhibition in which teams interact with the audience.

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IX. People's Choice Award

- A. The audience will decide their favorite machine for the people's choice award. This would be separate from the competition judging.
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X. 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 score will be determined by the following:
- i) Mean of *objective* scores from both rounds (30 points total)
  - ii) Addition of *technical* scores from both rounds (40 points per round, 80 points total)
    - (1) Each technical round score is the mean among the industry judges
  - iii) Single *style* score averaged among industry judges (30 points total)
- D. The total score is determined by adding the objective, two technical, and single style scores for a maximum of **140** points.

XI. Awards

- A. First, second, and third place awards will be given out to the highest scoring teams.
- B. In the event of a tie, the technical and style judges will determine the winner based on majority vote.
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## Scoring Rubrics

<b>Objective</b>				
Category	Criteria	Scoring	Points	Max
Final Step	Did the machine successfully complete the final step without any interventions? If not, how many interventions?	Doorbell Rung = 15 # of interventions = ____		15
Steps	Did the machine attempt to complete 30 steps?	30 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 inbound = 5 # of times out of bounds = ____		5
Total	Additional comments and total points:			30

<b>Style**</b>				
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 Score</b>				
<b>Average Objective Scores</b>	<b>Run 1 Technical</b>	<b>Run 2 Technical</b>	<b>Style</b>	<b>Total Points</b>
30	40	40	30	140

**\*\* The Style Section is the most subjective category but is equally as important as the Objective Section. It also contributes to the Purdue National Chain Reaction Competition's goal of engaging the community through showcasing engineering's creative and fun aspects. Below we have provided advice from the 2019's judges as guidance for this section.**

**What the judges liked last year:**

- **Costumes and props**
- **A story**
- **Speaking clearly and loudly (we will provide a microphone)**
- **Multiple team members participating**
- **Interacting with the audience**
- **Highlighting key steps and providing an overview for the machine's theme**
- **Being silly and having fun**

**What the judges DID NOT like last year:**

- **Describing every single step**
- **Only one person speaking**
- **Mumbling and monotone**
- **"This step does...This step does...This step does..."**

**Please do not treat this as a checklist but rather as a starting point for your presentation. Judges will be drawn to presentations that are unique, creative, and stand out.**