

## 2022 Roller Coaster Rules

### What is Tau Beta Pi and What Does it Represent?

Tau Beta Pi is a National Engineering Honor Society. The members of Tau Beta Pi are chosen from among the top junior and senior engineering students on the basis of distinguished scholarship and exemplary character. They are also expected to participate in community service activities.

The Iowa Alpha Chapter at Iowa State University has been recognized nationally for the service projects that it has organized, and has undertaken the challenge of hosting a roller coaster competition for middle and high school students. Marc Hermon, an Urbandale High School teacher, started this competition in order to reach out to high school students who have an interest in mathematics, physics and engineering. The competition gives students an opportunity to apply theory to a project that is both fun and challenging.

### Engineering

Creativity and problem solving are two skills that are hard to teach. This competition is designed to provide opportunities for students to apply and practice these skills. The problem solving skills that students learn will be invaluable in any field their career path takes them (engineering, science, or other areas). Experimentation and asking questions are essential to maximum performance. Students should not worry about making mistakes. They will run into many problems in the future that they have not foreseen. Engineering is a process by which ideas are tested and re-tested in an effort to produce the best working product. A good engineer knows one way to get something to work and many ways it won't work. This competition is designed to promote interest in engineering and science. The competition is open to all students in middle school and high school.

### Your mission:

Your mission, if you choose to accept it, is to build a roller coaster that transports a ball from a specified starting point to a specified end point (10-25 mm ball bearings generally work best) in 30 seconds  $\pm$  3 seconds, and complete a Rube Goldberg Challenge. Prefabricated construction toys such as hot wheels or any other type of track, tinker toys, Lincoln Logs, Legos or K'Nex may not be used. Any type of energy may be used except chemical (includes fire!), human, NUCLEAR, and electric. Basically, power for the coaster must be mechanical (springs, mouse traps, rubber bands, magnets and gravitational potential energy) and once the ball is moving on its own, no one may touch the ball, the coaster, or influence its performance in any way. The ball that begins the coaster does not have to be the one that ends, which means the energy from one ball can be transferred to that of another ball. Once one ball starts another ball, the first ball should stop shortly thereafter. Also, there is **no water allowed!**

## **This year's Rube Goldberg challenge:**

This year the challenge is to “**Roll a Die**”. Teams have broad latitude to determine how they want to accomplish this challenge. Therefore, be creative!

### **Roller Coaster Structural Requirements**

1. The Roller Coaster must be free standing.
2. No prefabricated toys can be used to create the functional parts of the roller coaster, although they can be used for the theme/decoration.
3. The assembled roller coaster must be no larger than 3' long by 2' wide <sup>[1]</sup><sub>SEP</sub> by 3' high (this is so the coaster will fit conveniently through a standard door opening and be easy to transport)

### **Competition Requirements**

1. A project display board should accompany the roller coaster containing the name of the roller coaster/team, the names of team member and information about the roller coaster and the physics concepts demonstrated by various components of the roller coaster.
2. The roller coaster should implement the Rube Goldberg challenge.
3. The roller coaster should have a specified starting point and a specified ending point.

### **Judging & Awards**

Judging will be based on the three categories: **Presentation**, **Overall Theme**, and **Technical Skill**. Before operating your roller coaster you must clearly state to the judges where your starting and ending points are located. Once this decision has been made it CANNOT be changed. If the ball traverses the entire coaster from start to finish AND does so in a time of 30 seconds +/- 3 seconds, then your technical score will be DOUBLED.

**Presentation: (30 points)** Judges will examine your professionalism, technical knowledge, and general speaking style (posture, eye contact). All team members should participate in the presentation). Team members should point out starting and ending points and describe all of their technical “tricks” at this time.

**Overall Theme: (30 points)** Judges will examine the team's use of a theme and how it is integrated into their roller coaster, the display board, the design of the roller coaster, the naming of the roller coaster, costumes, etc.

**Technical Skill: (70 points)** Judges will examine how many technical “tricks” were performed and assign a technical score out of 35 points. Your technical score is very important because if your ball travels from your start point to your end point successfully and does so in 30 seconds  $\pm$  3 seconds) the technical score will be doubled to a maximum of 70 points.

**YOU WILL RECEIVE UP TO THREE TRIES TO DEMONSTRATE A SUCCESSFUL RUN. A SUCCESSFUL RUN IS ONE THAT TRANSPORTS A BALL/BALLS FROM THE START POINT TO THE FINISH POINT AND COMPLETES THE RUBE GOLDBERG CHALLENGE IN 30 SECONDS  $\pm$  3 SECONDS)**

Teams may have up to 2 minutes to reset the coaster between unsuccessful runs, but the starting and ending points must remain the same. If a roller coaster can't be reset within the 2 minutes, it will be considered an unsuccessful run. Once a successful run has been demonstrated, the roller coaster will not be run again. (All contestants should examine the Judges Form to insure that the starting point, ending point and tricks have been identified correctly.)

Members of the Iowa State University Tau Beta Pi - Engineering Honor Society will do the judging. Teams of high school students and middle school students will be judged separately. Awards will be presented for 1st, 2nd and 3rd places for both the middle school and high school teams. At the judge's discretion, three additional awards may be given to middle school and high school teams for Overall Theme, Technical Skill and Presentation.

## **When & Where**

The competition will be held Wednesday, April 20, 2022, beginning at 9 am in the Atrium of Howe Hall on the Iowa State University campus. Maps and directions for reaching the location of the competition and vehicle parking areas will be made available on the Roller Coaster website: <http://iowaalpha.tbp.org/roller-coaster-competition/>.

## **Teams & Coaches**

On-line registration for the competition is available on the Roller Coaster website: <http://iowaalpha.tbp.org/roller-coaster-competition/>. Each team (2-5 high school students and 3-8 middle school students is recommended) may enter only one roller coaster. Each school may enter as many teams/roller coasters as they would like. Coaches that are parents or teachers may participate with the team by expressing ideas and suggestions and providing workspace and tools; however, the coach should not actively participate in construction of the roller coaster.