

Design/Build Challenge Instructions



Challenge: Design and build a prototype for an amusement park ride.

Engineers design solutions to a variety of problems that affect society, design new, fast ways to communicate, and more efficient transportation. They design small systems, like cameras in cell phones, and large systems like new means to travel to space. As the world learns new ways to cope with life during and after the pandemic, the part that engineers play in designing leisure activities is apparent. The design of video games, sporting equipment and venues, and amusement park attractions all contribute to help our lives be more rich and fun.

In this challenge, you will design a prototype for a new amusement park ride. In the full scale model, riders will be loaded into round cars, and the cars will roll freely on a track to an end where they will disembark. As part of the design, rolling vehicles must take a set amount of time from start to finish. The rolling vehicle will be released or launched at the beginning, and stopped at the end. It will roll on its own, freely, with no intervention and no means of propulsion.

Your task: Your team has been tasked to design a miniature prototype. The total time allowed for prototyping is two hours, plus up to fifteen minutes to complete and upload all documents (see the timing information given). The rolling vehicle will be simulated by a marble. For this prototype, everything must be constructed out of the specified materials detailed on the Materials List – no extra materials are allowed.

The goal is for the marble to travel from the start position to the end position, arriving as close to 30 seconds as possible (start to finish).

Start: The marble may be dropped or placed into a start position and allowed to roll. No human contact or intervention may occur once the marble leaves the start position.

On the track: The marble may not be touched. Human interaction is not allowed beyond the start line. Anything designed, built, and/or implemented using the given list of supplies may interact with the marble (although they may not be controlled, operated, or touched by humans).

Up to two loops should be incorporated into the path. More loops are allowed, but only points for up to two will be added to the total score. The loop must be part of the track and the marble must travel through the loops.

Teams should minimize the cost of the track; using fewer materials will result in a better score.

Finish: You must determine and clearly identify the starting line and finish line. Timing begins when the marble passes the starting line and ends once it passes the finish line.

Only one video of a single attempt may be submitted; however, teams should film each attempt, as any successful attempt may be submitted as the entry for that team.

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Materials: Each team must have one set of the required materials listed below. Please note the color of all materials, unless noted, is not relevant. **Images and links are provided for reference only.** Items do not need to be purchased from the links provided. It is up to your discretion as to where you purchase the materials. Materials may also be collected from existing supplies that are available to you.

REQUIRED MATERIALS

QUANTITY	SIZE	DESCRIPTION (Click link for Option to Purchase)	EXAMPLE
100 Sheets	8.5" x 11"	Copy Paper/Printer Paper	
10 Feet	Any Ply	Cotton Twine or String	
2	20" x 30"	Foam Boards	
1 roll	1" x 60 yds. (max.)	Masking Tape, general purpose	
10	Standard, No.2	Non-Mechanical Pencils, sharpened or unsharpened	
6	22" x 28"	Poster Board	
20	Any	Rubber Bands	
1 box	100 count, standard size	Smooth Paper Clips	
1	½" diameter	Standard Player Marble	
1 roll	¾" x 250" (max.)	Transparent Tape	

REQUIRED TOOLS (not to be used as part of the final build)

1	Standard	Scissors and/or a non-electric cutting device (exacto knife) used under adult supervision	
1	Standard	Timer/stopwatch The app on your phone is acceptable.	

Set-Up: Flat surface on which to build and test your structure. For example, the floor or any flat tables in classrooms, cafeterias, media rooms, or sturdy temporary tables.

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Determining cost:

Cost is per item used. Using any part of an item, or damaging an item, counts toward the total cost. For example, if a team uses a pencil, it counts as used. If a team breaks a pencil and uses half, it counts as a full pencil. Bend a paper clip to poke a hole? It was used, and counts as a paper clip. If a team cuts out one small part from each of the six poster boards, it counts as using six poster boards.

Timing:

15 minutes prior to start time: **Releasing the challenge:**
Challenge released to student teams.
Teams may begin designing, but must not begin building.

120 minutes: **Design, build, test, iterate:**
Team members will construct a prototype of their design using only approved materials from the Materials List and iterate on their design. All testing must be completed within this 120 minute block.
Record a video each time your marble runs from start to finish. Only one video per team may be submitted.

15 minutes: **Submit:**
Teams complete the Datasheet and Honor Statement. Upload both forms and video link using the instructions and submission link provided in your online coach account.

Video Submission:

Select the video that shows your best time. Only one video may be submitted. State your school name and participant ID at the beginning of the video. Each video must be continuous (not edited). Each video should show:

- A stopwatch timing the run from start to finish, clearly showing the total time. The stopwatch must not leave the frame of the video.
- The release/launch of the marble. It may be placed, pushed, dropped at the starting position.
- Timing begins the moment the marble passes the starting line.
- There may be no contact or interference by humans once the marble passes the starting line.
- The complete path taken by the marble.
- The marble crossing the finish line or landing in the finish spot. The stopwatch must be visible during the entire run, including at the end when timing is finished and “stop” is pressed on the stopwatch.

Failure to display the stopwatch during the entire run will result in a zero score for timing.

Upload the video to a hosting platform (for example, YouTube or Vimeo). Submit the URL link using the provided submission link and instructions. The video link must be “unlisted” so it is viewable for judging. Video upload instructions are available in your online coach account.

Videos that are not able to be viewed for judging will result in disqualification.

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Evaluation Criteria:

The goal is to get your marble from start to finish in 30 seconds. The closer to 30 seconds you are, the better your timing score will be. Total times and scores are shown:

Timing (more accurate is better) (40):	
Successfully completes track in 29-31 seconds	40 points
Completes from start to finish, <10 or >50 sec	15 points
(if not successful) able to successfully start and follow some track, not able to finish properly	10 points
Loops (up to 2) (10):	
Loop (marble completes a loop)	5 points per successful loop
Cost (lower is better) (30):	
Paper	1 per sheet
String	5 for up to 5 feet, 10 for more than 5 feet
Foam Board	20 for any part of a foam board
Masking tape	5 for up to 5 feet, 10 for more than 5 feet
Pencil	5 per pencil
Poster Board	15 for any part of a poster board
Rubber Band	2 for each rubber band
Paper Clip	1 for each paper clip
Transparent tape	5 for up to 5 feet, 10 for more than 5 feet

Submission: Complete the Design/Build Challenge Team Datasheet and submit the completed form to your proctor. Verify the information is written clearly and accurately. **Coaches** must then submit the form to TSA along with the video URL and Competitor Honor Statement using the instructions and submission link provided in your online coach account.