

STEM Design Challenge by ThermoFisher

1. **DESCRIPTION:** Teams must build a structure on site to solve a creative engineering task using only the materials and tools that they have brought in their challenge box. Teams must prepare their challenge box before the competition and practice solving engineering tasks using the allowed materials.
2. **ESSENTIAL STANDARDS ALIGNMENT:** 4.P.2, 5.P.1, Science as Inquiry
3. **TEAM OF UP TO:** 3
4. **MAXIMUM TIME:** up to 40 minutes to build, up to 5 minutes present and test. **This may be scheduled as a walk-in event at various tournaments.**
5. **TEAMS:** Teams MUST bring the specified tools and their box full of K'nex materials. **Teams may bring only 1 picture no larger than 8.5" x 11" of their device. No other resources are allowed.**
6. **EVENT LEADERS:** Event leaders will provide the golf ball and cup, score sheets and any measuring devices needed. **The type of floor surface will be provided to coaches at least one month before the competition.**
7. **SAFETY REQUIREMENTS:** None
8. **IMPOUND:** Yes. Teams must drop the challenge box off at the time and place specified by the tournament director. The box must be clearly labeled with the school/team name and team designation (Varsity, JV, etc.).
9. **THE CHALLENGE BOX:**
 - a. All materials and tools must be brought in a box with a lid; the outside dimensions of the box with lid in place can be no greater than 30.0 cm x 35.0 cm x 50.0 cm (example: a common 10 ream copy paper box with the lid on meets this requirement). With all materials and tools in the box, the lid must fit all the way on the box and close completely.
 - b. Teams may construct their own box or repurpose a box that is within the specified dimensions, made from any material. The box must not be used as a part of the device.
 - c. The box must be impounded and measured before the event begins.
 - d. Varsity and JV teams from the same or different schools may not share the same challenge box nor materials and tools in the challenge box.
 - e. **BUILDING MATERIALS:** Teams may only bring the following building materials:
 - i. K'nex pieces. No K'nex motors or other electronic components may be used. No other brands or kinds of building materials may be used. Pieces can't be preassembled in box. Event leaders will disassemble or remove any pieces not allowed by these rules.
 - ii. Rubber bands – any size, brand, or quantity.
 - iii. String – any size, brand, or quantity.
 - f. Teams must impound their box before the competition. Event leaders will inspect the boxes and their contents while in impound, and remove any disallowed items. Teams do not need to be present for this.
 - g. Teams should make a reasonable effort to organize the supplies within the box neatly for efficient check-in and ease of inspection by the event leader. Teams may organize box supplies in clear plastic bags or other clear containers. The bags and containers must not be used as building materials.
 - h. **TOOLS:** Tools must not be used as part of the device. All tools must also fit within the closed box. Teams may include scissors, ruler, a tape measure, and a stopwatch in the box.
 - i. Any items that are not allowed will be confiscated by the event leader at impound and can be picked up after the competition.
 - j. Team members must build the device on site using only the materials brought in their box.

10. **THE CHALLENGE:**

- a. Once teams enter the event area to compete, they may not leave the area or receive outside assistance, materials or communication until they are finished competing. Only participants and event leaders will be allowed in the event area while teams are competing. **Teams violating this rule will be disqualified.**
- b. Teams are to design and build a putting machine that will **putt a golf ball into a cup**. The maximum height of the device is 1 meter. The entire device must fit in an imaginary box that is 1m wide by 1m long by 1m high in any orientation on the floor.
- c. Structures must be free standing and cannot be attached to a table, floor or any other support.
- d. Team members will not be allowed to stand on chairs, tables, ladders or anything else to construct the device or release the putting arm.
- e. A team member will place a golf ball on the floor in a position where it will be struck by the swing of the putting arm. The team will place the cup on the floor with its nearest edge at least 50 cm from the spot where the ball touches the floor and where they think the device can putt the ball into the cup.
- f. When given a signal from the event leader, one team member will draw back a lever arm on the device, pause, and then release it so that the lower end of the arm strikes a golf ball causing the ball to roll across the floor and into a cup. The cup will consist of a large plastic or Styrofoam cup that is sliced in half vertically and laid on the floor with its side up. A mass may be taped to the upper side of the cup so that it will be more stable on the floor.
- g. If the ball strikes the cup, the team will receive 25 points. If the ball goes into the cup, 50 points will be awarded. If the ball bounces back out of the cup, 50 points will still be awarded. **In order to be considered “in” the cup, the event leader must be able to slide a piece of paper down the front opening of the cup without touching the golf ball.**
- h. To qualify, a device must have a putting arm that can be released so it will swing and strike the golf ball. Otherwise, only participation points will be awarded.
- i. If the golf ball strikes or enters the cup, two bonus points will also be awarded for each cm of distance between the original spot for the ball and the closest edge of the cup.
- j. The team may try a second putt within their 5-minute testing window, at the same or a different distance. Teams may adjust their device before the second putt by repositioning the device or repositioning or removing pieces already on the device, but no additional pieces can be added after the first putt. The highest scoring putt will be chosen for the score.
- k. Ties will be broken using the total score for both putts. The second tie-breaker will be the shortest device from the floor to the center of the axle of rotation for the putting arm.
- l. The minimum putt attempt distance allowed is 50 cm.
- m. Teams will have a **maximum of 40 minutes** to construct the specified device. Teams must not modify their device after the construction period has ended. Teams that complete construction early may be judged early.

11. **SCORING:**

- a. Teams will be ranked into tiers based on adherence to the challenge instructions. Within each tier, teams will be ranked based on the scoring criteria for the challenge.
 - Tier 1: Teams with no violations
 - Tier 2: Teams whose device violates any part of sections 9 or 10. Some examples are:
 - i. If the device is higher than 1.5 meters.
 - ii. If the putting arm leaves the required dimensions when drawn back to make a putt.
 - iii. If a team member pushes the lever arm rather than simply releasing it to make a putt.
 - iv. If a team impounds their box or any materials late.
- b. Any team that impounds a box but fails to attempt the build will be considered a “No Show.”

12. **RESOURCES:** <http://www.sciencenc.com/event-help/STEMDesignChallenge.php>