Rube Goldberg Challenge 2009-2010

LEVEL: Middle & High School

TYPE OF CONTEST: Team

COMPOSITION OF TEAMS: 5-6 students per team

Objective: Teams will design a Rube Goldberg Device to complete the task set forth in the rules.

OVERVIEW: Teams will use simple machines and everyday household items to construct an innovative, logical device that will accomplish a given task in the most complex manner imaginable.

TASK: Drop a marble into a medicine cup in the closest time to the Target Time of 30 seconds.

MATERIALS: Testing Equipment: UCI MESA will provide the official marble and medicine cup to all teams.
Device: Any ordinary household items may be used to construct the device. All materials are legal and optional with the exception of those listed below.
Illegal Materials: No electronic motor or electronic parts may be used in the construction of the device. The device may not contain any substance that may be considered hazardous including, but not limited to: fire, flammable substances, sharp objects, etc.

RULES: (Failure to adhere to any of the below rules will lead to disqualification)

1. Device may have a maximum operating area of 2’Lx2’Wx30”H.
2. The marble and the cup may not be altered except to attach it to the device. UCI MESA will provide the official testing marble and cup to each team in advance of the competition.
3. The device must accomplish the task in a series of steps. The device must be put into motion by a single trigger that will be initiated by a team member. All subsequent steps must be put into motion by the action of the step before. (i.e. Step 1: Student cuts a string causing a weight to fall; Step 2: Weight lands on mousetrap triggering the mousetrap hammer/bar to pull a string attached to a wooden block; Step 3: The wooden block releases a ping pong ball down a track which rolls into a domino track...)
4. A step is defined as a transfer in energy from one action to another action. Identical transfers of energy in secession will be considered one step. (i.e. A set of dominos falling into each other is considered one step)

** A more detailed explanation of a step is given in the attachment: “Definition of a Step”.**
5. The device must have a minimum of 5 steps. There is no maximum number of steps.

6. Each step must be essential in triggering the next step in order to eventually complete the task. A step may not be purely cosmetic in nature or act as a failsafe. (i.e. Step 3 will activate whether or not it is directly triggered by step 2)

7. The marble and the cup must be visible prior to the start of each trial.

8. The marble's starting position must be at least 10 inches from the rim of the cup. Measurement will be taken in a straight line from marble to cup.

9. The trial ends once the marble falls into the cup. The marble must remain inside the cup.

10. The device must complete the task within 60 seconds, after which no score will be given for that trial.

Guidelines:

1. Any loose, flying objects should remain within the boundaries of the device during testing. Teams will be penalized for items that extend beyond the device boundaries.

2. Each team will submit a typed description of their device. The description should include the following: Materials list, Description of all steps, Diagram or picture labeled with device dimensions and steps.

3. Each team should submit a completed registration form.

Judging:

1. Each device will be placed on a standard 6ft table for judging. The device may extend beyond the table surface as long as the total device area does not exceed 2'Lx2'Wx30"H.

2. Only one team member will be allowed to interact with the device.

3. Each team will receive 1 minute to set up their device.

4. The timer will start when the first step is triggered.

5. Devices which do not complete the task will receive 0 points for that trial.

6. Following the set up period, teams will await the signal from the judge to initiate the device.

7. Only one false start allowed per trial. A second false start will disqualify that trial.

8. Each team will be allowed two nonconsecutive trials. Each trial will be scored and the final score will be based on the higher of the two trials.

9. Each team will have 5 minutes between trials to make adjustments to the device. Time will begin immediately after the first trial has concluded. A maximum of two team members are allowed to make the necessary adjustments.

10. Points will be awarded based on the following:
   1. Completion of the task
      a. Target Time Accuracy
      b. Number of steps
      c. Complexity of steps
   2. Creative use of materials
   3. Description of Device

Awards: Middle School Awards will be given for 1st, 2nd, & 3rd place.
High School Awards will be given for 1st, 2nd, & 3rd place.

Attachments: -SCORING GUIDELINE
-DEFINITION OF A STEP
-REGISTRATION FORM
SCORING GUIDELINE

Judges will award points in the following categories.

1. Creativity/Engineering Design: 10 points max
   a. Engineering design: 0-5 points
   b. Creative use of materials: 0-5 points

2. Device Description: 15 points max
   a. Materials list: 0-5 points for completeness
   b. Description of steps: 0-5 points for completeness
   c. Labeled diagram/picture: 0-5 points for completeness

3. Spirit of Rube Goldberg: 35 points max + BONUS
   a. Number of steps: 20 points
      i. Teams will receive 2 points per step up to a maximum of 20 points.
      ii. **BONUS:** One point will be awarded for each additional step.
   b. Complexity of device: 15 points
      i. Teams awarded points based on the logical complexity of the device

4. Target Time (T.T.): 40 points max
   a. Team Target Time is the closer of the team’s two trials to the target time of 30 seconds.
   b. The team with the nearest time to the desired time of 30 seconds has the best target time and will receive 40 points.
   c. The following equation will be used to score the T.T. score:

   \[ T.T. \text{ score} = \frac{(Best \ T.T.)}{(Team's \ Best \ T.T.)} \times 40 \]

   **Example:**
   o Time that my marble is in motion: 20.75 seconds in motion = **9.25 seconds**
     (Team’s T.T.) from the desired time of 30 seconds.
   o Device time that had the marble in motion the closest to 30 seconds: 35.68 seconds in motion = **5.68 seconds**
     (Best T.T.) from the desired time of 30 seconds
   o Using equation: T.T. score = (Best T.T.) \div (Team’s T.T.) \times 40
   o Hence, T.T. score = \( \frac{5.68 \text{ seconds}}{9.25 \text{ seconds}} \times 40 \)
   o Therefore, my T.T. score = 24.56

5. Teams that do not submit a complete registration form will have 5 points deducted from their final score.
6. If any objects extend beyond the device boundaries during testing, the team will incur a 5-point deduction.
7. The team with the highest cumulative score wins. In the event of a tie, the tied teams undergo the following tie breaking procedures:
   a. If tied, the best Target Time will be declared the winner.
   b. If still tied, the top Spirit of Rube Goldberg score will be declared the winner.
   c. If still tied, the top Device Description score will be declared the winner.
   d. If still tied, duplicate awards will be given.
A completed registration form should accompany the project upon arrival. If a registration form is needed when your team arrives, then the team will forfeit their registration points for the competition.

Rube Goldberg Challenge Registration Form

Instructions: Type or clearly print the requested information below. Illegible writing may result in disqualification.

School Name: ___________________________ Advisor: ___________________________

Team Members (each team must be 5 - 6 students per team):

<table>
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<th>Last Name</th>
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