MESA Mathematics Engineering Science Achievement

MESA DAY CONTEST RULES 2016-2017

Rube Goldberg Device

Demonstration / Pilot Event

LEVEL: Grades 6 - 8

TYPE OF CONTEST: Team

COMPOSITION OF TEAM: 2-4 students per team

NUMBER OF STUDENTS: Preliminary – As determined by your local MESA Center
Regional – 3 teams per MESA Center

SPONSOR: Ben Louie, Associate Director, USC MSP

OVERVIEW: Students will design and construct a device that utilizes three different sequential and dependent actions from two different energy categories that will ultimately launch a vinyl kick ball the farthest distance in the least amount of time. **Participation logistics, limits, and competition facilities may vary by host site. Advisors and students are responsible for verifying this information with their center director.**

MATERIALS: All materials are legal with the exception of remote control devices, hazardous materials or unsafe energy.
The Host Center will provide the following:

- 2-inch vinyl kick ball / hacky sack
- Safety goggles

GENERAL RULES:

1) The students' full name, school name, grade and MESA Center must be clearly labeled on the device. A 10% penalty in the score will be assessed for failing to properly label.
2) All parts of the device must fit into a 75 cm by 75 cm by 100 cm rectangular prism with the 100 cm defined as the height. No parts may extend outside of the defined rectangular prism at any time during inspection or during competition, except the single operation to initiate the device in Rule 3.
3) The device must be initiated by a single operation (e.g. pull a string, flick a switch, push a button, etc.) provided by the team. The single operation MUST be performed outside of the *Safety Zone* and the *Landing Zone* (see Attachments/Appendix Section).
4) No human power may be used to add potential or kinetic energy for the entire operation of the device, including initiation.
5) The device must incorporate a total of three (3) actions that are sequential and depend upon the previous action. The three actions must use two (2) different categories of energy, as

listed below. The sequence of actions must end with an action that launches the vinyl kick ball. The action to initiate the device does NOT count as one of the three required actions.

a. Categories of energy, **which MUST be safe and not cause personal injury or damage to host facilities**, are LIMITED to the following:
    i. Gravity (e.g. free fall, ramps, etc.)
    ii. Springs (e.g. tension springs, bungee cords, rubber bands, torsional springs, etc.)
    iii. Motors/engines (electrical power will NOT be provided)

6) The device must be able to load the host supplied vinyl kick ball prior to the initiation of the device. No alterations to the vinyl kick ball are allowed.
7) The device must launch the vinyl kick ball within 60 seconds of the initiation of the device.
8) The device must have moving parts visible at all times once the device is initiated to verify actions and categories of energy (see General Rule 5).
9) All construction materials are acceptable, with the exception of remote control devices, explosives, caustic chemicals or other hazardous materials that may cause personal injury or damage to host facilities.

JUDGING:

1) Devices will be checked for specifications prior to the start of the competition. If devices are disqualified during the specification check, design changes will not be allowed.
2) Each device will be allowed two (2) non-consecutive launches.
3) Repairs are only allowed with replacement parts and materials.
4) Each device must be ready when called or team will forfeit that launch.
5) Each team will be given up to 60 seconds to prepare device, load vinyl kick ball, and verify to the judge the three actions and the two different categories of energy.
6) One team member will be responsible for the initiation of the device and will indicate to the judge that the device is ready to launch. The team member must wait until the judge gives the "START" order.
7) Judge will record the following:
    a. Time will be measured from the initiation of device (i.e. "START" order) to the time the device launches the vinyl kick ball to the nearest 00.01 seconds.
    b. Distance will be measured from the *Launch Line* to the point where the vinyl kick ball initially lands or leaves the designated *Landing Zone*; measurement will be done perpendicular to the *Launch Line*. See Attachments/Appendix Section for competition area specifications.
8) If the device does not launch the vinyl kick ball within 60 seconds of the initiation of the device, the judge will declare a mistrial; team will receive zero (0) points for that launch.
9) Team members may not touch or interfere with the device once the initiation has been triggered.
10) The order of the competition will be randomly selected.
11) All team members and spectators must stand outside of the *Safety Zone* and the *Landing Zone* during each launch.

SCORING:

1) Team distance-to-time ratio = distance in cm divided by launch time in seconds (00.00).
2) The best distance-to-time ratio of the two launches will be used.

AWARDS:

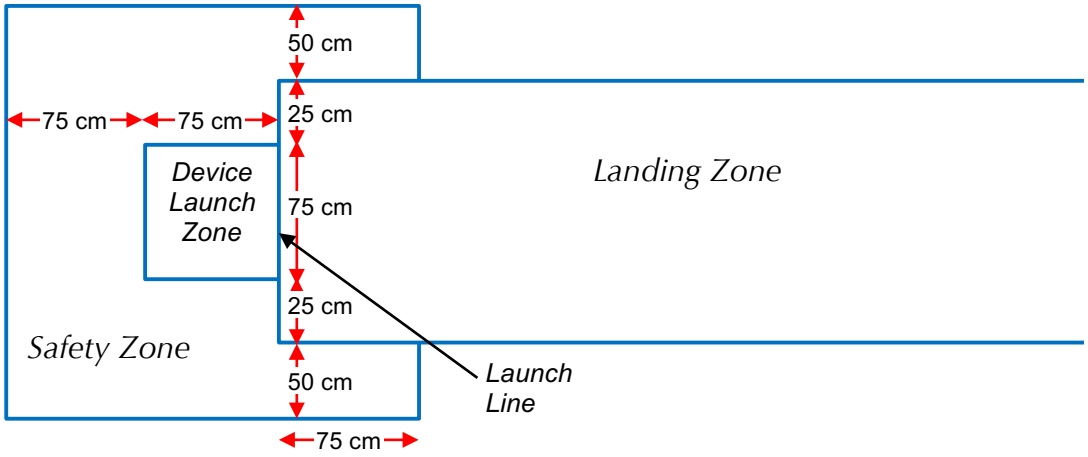
- Medals will be awarded for 1st, 2nd and 3rd place based on greatest distance-to-time ratio.
- Ribbons will be awarded for Innovative Engineering Design.
- Only teams placing in the distance-to-time category will advance to Regional MESA Day.

ATTACHMENTS/APPENDIX:

- Competition Area Specifications
- Recommended Equipment
- Inspection & Score Sheet for Rube Goldberg Device

Competition Area Specifications

- *Device Launch Zone* is 75 cm by 75 cm and centered along a 125 cm wide *Landing Zone*.
- *Safety Zone* is 2.25 meters by 2.25 meters and centered to the *Device Launch Zone*.
- *Landing Zone* is 1.25 meters wide by at least 10 meters long.



Recommended Equipment

- 2-inch vinyl kick balls / hacky sacks
- Measuring tape
- Blue painters tape to outline the *Device Launch Zone*, *Safety Zone* and *Landing Zone*
- 1 stop watch to record launch time
- 4 safety goggles

INSPECTION AND SCORE SHEET FOR RUBE GOLDBERG DEVICE

Middle School – Grades 6 to 8

Copies of this inspection and score sheet will be provided by the MESA Day Host Center.

Student Names: _____

School: _____ MESA Center: _____

List three actions of device

1. _____
2. _____
3. _____

List two different categories of energy used

1. _____
2. _____

Section below to be completed by Judges

INSPECTION LIST:	**YES**	**NO**
All parts of device fit into 75 cm x 75 cm x 100 cm	☐	☐
Device is initiated by a single operation performed outside of *Safety* and *Landing Zones*	☐	☐
Device incorporates three (3) actions that are sequential and depend upon the previous action (do not count action to initiate device as one of the three)	☐	☐
Two (2) different categories of energy used	☐	☐
Device able to load vinyl kick ball prior to the initiation of device	☐	☐
No remote control devices, hazardous materials or unsafe energy are used	☐	☐
Device labeled properly (students' full name, school name, grade and MESA Center)	☐	☐

Innovative Engineering Design (ranking – 1, 2, 3, etc.): _____

LAUNCH 1

Distance (cm): _____

Launch Time (00.00 seconds): _____ Distance/Time Score: _____

Mistrial (reason):

LAUNCH 2

Distance (cm): _____

Launch Time (00.00 seconds): _____ Distance/Time Score: _____

Mistrial (reason):

Device Labeling Penalty (10% of best of two launches) ..... - _____

Final Score (best of two launches) _____