

Mission Possible

Purpose

Design, build and test a Rube Goldberg-like device that incorporates at least 10 energy transfers and 5 simple machines connected in a series that completes the required task.

Competition

At the prompting of the teacher, a team member will activate the device. This is the only time a participant may touch the device once started without penalty. A bonus *completion task* is to be able to raise a golf ball at least 15 cm vertically above its **starting** position. The final *completion task* is to be able to expel a golf ball from the device so that the ball comes to a complete stop 1 meter away from the end of all parts of the device. The device must fit on top or around one lab station. At least 5 different simple machines must be used. Energy transfers of the same type in succession will count as only one transfer.

One machine can be used to activate a stored energy source, which will enable the operation of the next machine. Stored energy sources (e.g. springs, batteries, gravitational potential) and electromagnetic devices (e.g. motors, solenoids, magnets) are not simple machines but may be used as interfaces between the simple machines. For example, the output work of one machine causes stored energy to be released that provides the work input to the next machine. Batteries may have an electrical potential difference no greater than 9 volts.

The device may use as many simple machines as possible. There is no requirement for unique simple machines. However, machines of the same type used together will count as one machine. Each machine must contribute toward the completion of the task. Energy storage units (e.g. springs, batteries etc.) may be activated prior to starting.

If the device stops, jams or fails, the team will be allowed to adjust the device to continue operation. But will receive a penalty and points will be deducted.

Scoring

The scoring is based on the successful operation of each simple machine and whether the task is complete.

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| 1. Successful completion of each required task | 50 points |
| 2. At least 10 energy transfers | 25 points |
| 3. 5 different types of simple machines. | 25 points |
| 4. Bonus points for raising the ball 15 cm above starting position | 20 points |

Tie Breaking Criteria

The team that expels the golf ball closest to the 1 m mark.

Team Members: _____

Required Tasks

1. Draw a diagram of the device with labels indicating the simple machines and the energy transfers. (Attached on a separate sheet of paper)
2. Among the group members, bring in a box of supplies from home to build the device. There may be no more than 100 items, and items must be already at your house. No item bought specifically for this contest will be admitted.
3. Be able to construct, demonstrate, and clean up the device in 1 hour's time.
4. Submit a time for length of device running time. Be able to calculate the average speed of the device.
5. Write a paper evaluating the effectiveness of the design, how you would have improved it if you had to do it again, where all the energy in the device came from and went, and the individual contributions of each group member to the project. Describe the responsibilities of each team member and how much they helped in completing the task. If one member did not contribute as much as the others, all other members must initial the description. This paper is a large portion of your grade- what you write will affect, either positively or negatively, your individual grade!

Technical paper requirements- 12 point font, standard margins, typed.

Day 1- Explanation of Rube-Goldberg machines and the task.

Meet with group to plan

Day 2- Plan the device with group.

Construct the device and work out the running of the device.

Diagram the device and then clean up.

Day 3-5- Reconstruct the device.

Run the device as part of the contest.

Grade for group:

Completion of each required task

Number Completed

10 Energy transfers

5 Simple machines

Points deducted for lack of participation

_____ (for individual grades)

Bonus points

Total
