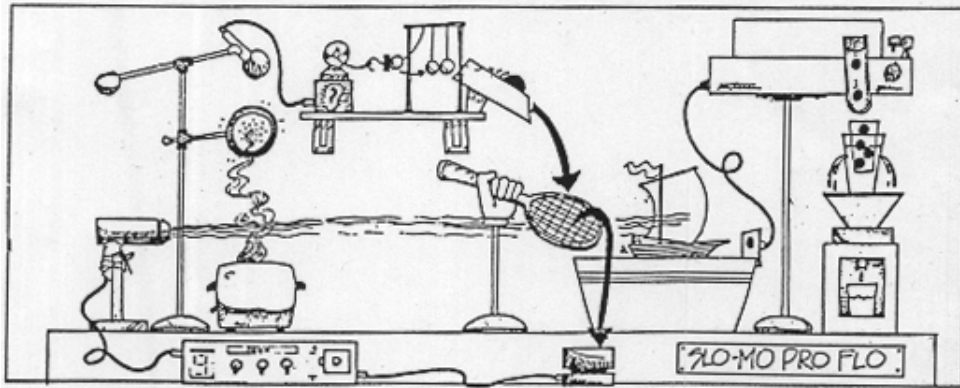


The Project

- **Introduction**

The 2nd Quarter Physics Project is entitled “The Rube Goldberg Project”. In this project, you will demonstrate your knowledge of principles in physics by designing, creating, and explaining a Rube Goldberg machine that is a very *inefficient* device to perform a specified function.



A sample of an engineering student's version of a Rube Goldberg machine is shown above. The challenge was to build a machine that would fill a cup of water in 20 or more steps. The task is accomplished in true Rube Goldberg fashion by burning a waffle in a toaster, which sets off a smoke alarm, which activates a microphone, which then starts a small electronic motor, which...well, you get the idea. The cup of water is shown being filled at the lower right of the picture.

Details will be given in class and on a second document about this year's objective and these details, along with those written in this document, are considered part of “the rules” of the project.

- **Team Organization**

Each team will consist of at least four but no more than five Physics Students. These teams may be comprised of students from any of Mr. G's classes – in other words, if you are in second block, your team may have members from first or fourth block, etc... Each team member is expected to actively participate in the design, construction, and testing of the project. **All team members must be present for official testing.**

The Project

- **Team Objectives:**

- a. To design and construct a machine from ordinary materials found in and around the home that will successfully accomplish the major objective.
- b. The machine must complete a full cycle in no more than five minutes. A full cycle includes a first run to completion of the task, a complete reset, and a second run to completion of the task.
- c. Each machine must incorporate a minimum of three energy conversions, with at least one energy conversion that is NOT $PE_g \leftrightarrow KE$.

- **Construction and Construction Materials:**

The machine must be constructed from ordinary materials supplied totally by the team members. Acceptable materials may include, but are not limited to: string, tape, balloons, wire, screws, nails, wood, glassware, bottles, tacks, soda straws, Popsicle sticks, toothpicks, crafting materials, Lego's, etc. The machine should also be sturdy and reliable.

- a. Each machine must be safe and approved by Mr. Gigante at the proposal time. Any questionable items or changes from this design must be given approval by Mr. Gigante before the due date.
- b. A machine must not imply profane, indecent, or lewd expressions.
- c. A machine may not incorporate any live animal.
- d. A machine may not display any corporate logos.
- e. Each team is responsible for the security of its own machine, but intentional destructive action against other machines is cause for failure.
- f. A penalty will be assessed for any human intervention on a machine in motion.
- g. Any loose or flying objects must remain within the set boundaries of the machine. The maximum size of the machine is 1 meter wide x 1 meter deep x 1 meter high.
- h. No combustible fluids, explosives, open flames, or hazardous materials.

Since the team members will provide all materials, it is strongly recommended that those materials be inexpensive, easily maintained and disposable.

Finally, the machine when finished must be portable (able to be brought from home to school and back again without damage to life or property) and free standing on the classroom floor, or desks when tested.

The Project

- **The Testing Environment:**

The testing area for the machines will be provided by Mr. Gigante in room 409 or 401. Each team will be expected to set up their machine within ten minutes of being told to do so. The set up time includes presetting any parts of the machine such as attaching and arming an energizer/activator, stretching or compressing a spring, raising a weight to certain levels, aligning machine parts, etc.

Each team is required to clean up immediately following the testing of their machine.

- **Testing The Machine:**

All team members must be present for the testing. Before the physical test of the machine, team members will briefly (<5 minutes) overview the mechanics of the project, clearly identifying each step and each energy conversion. When given the signal by the evaluator Mr. Gigante, a team member will start their machine to begin the test. From this point until the objective is reached, there should be no human intervention on the device.

- a. All testing will be performed during Regents Week in January on the dates and times specified by Mr. Gigante. Special arrangements may be made to test at other times, **but no class time will be used for official testing.** Teams will sign up for a testing day and time on a sign up sheet in Mr. Gigante's classroom.
- b. Each team will be allowed three trials and the best of the three trials will count for score. The three trials need not be scheduled on the same day and the machine may be modified or otherwise improved between trials.
- c. The evaluator will be the official judge.
- d. If the machine fails to perform as expected by the team prior to the expiration of the five-minute time limit, the team leader can alert the evaluator that the trial is being aborted. This will allow human intervention on the machine in order to prevent damage that may jeopardize the success of future trials.
- e. If the trial is aborted, this aborted attempt will count as an unsuccessful trial and the machine may be retested depending on the number of remaining trials.
- f. To qualify as a successful run the machine must meet the objective within five minutes of activation. If not, then that run will be considered as unsuccessful but count as a trial.
- g. If the machine has failed to meet the objective within the five minute time span mentioned above on all of its three trials then that machine will automatically be assigned the minimum score (140 points) called for in the grading section below.

The Project

• Grading The Project:

All members of any given team shall receive the same total grade, which will count as a test grade according to the scoring rubric that follows:

- a. 140 points (minimum score) will be awarded for constructing a machine according to the previous rules and attempting to meet the objective in the allotted time. The evaluator will be the final judge as to whether or not the constructed machine was a bona fide attempt or not. If not then zero points will be awarded.
- b. 30 points will be awarded if the machine actually meets the objective anytime during one of the five-minute maximum allotted time trials.
- c. An additional 30 points will be awarded if the machine successfully completes one cycle as described in the beginning of this paper in the five minute time period.
- d. The maximum possible score therefore for the design and successful testing of the machine is 200 points.
- e. Extra points may be awarded for creativity, originality, etc.
- f. Penalties will be instituted if insufficient numbers of steps or energy conversions are designed.

Please remember that every team member will get the same score as their recorded grade for this 2nd Quarter Project. An individual team member's grade, however, may be changed at the discretion of the teacher based on lack of participation, effort, etc.

No part of this project will be accepted late. No exceptions!

Hopefully this project will be enjoyable in all of its phases, but please remember that ultimately you and your team members must work through this together especially when the "machining gets tough". In general, errors and pitfalls are usually the result of either not following project guidelines or rushing the project together at the last minute (which subsequently leads to a tendency to not follow directions). Thus, give yourself plenty of time and take the time and effort necessary to be acquainted with the guidelines described on these pages.

***Good Luck and better living through understanding
your physical environment!***