MIDDLE SCHOOL CHALLENGE: RUBE GOLDBERG MACHINE

Core Outcomes:

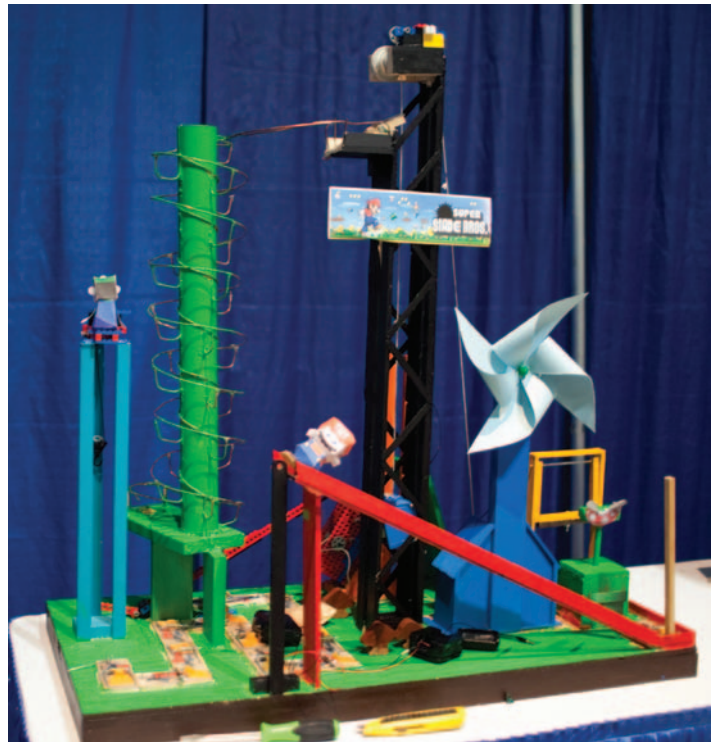
Students will be able to point out and explain each simple machine that is incorporated in their project design. Students will be able to demonstrate the principles of potential energy, kinetic energy, and transfer of energy. Students will be able to give an example of the six simple machines: lever, inclined plane, pulley, gear, screw, and wheel & axle.

Challenge:

Construct a Rube Goldberg Machine that uses at least 5 steps or 5 simple machines, and takes the greatest amount of time to turn off a light switch.

Rules:

- **Dimensions:** The entire machine may not be larger than 24" (60.9cm) wide, 36" (91.4cm) long, and 60" (152.4cm) high. All machines must be displayed and operated at their assigned table which will be approximately 30" (76.2cm) high.
- **Number of Steps/Simple Machines:** The machine must complete its task in no fewer than 5 steps or 5 simple machines. However, the maximum number of steps or simple machines that will be scored is 10.
- Each step/simple machine must be **clearly** labeled in sequence.
- A step is considered to be an action that triggers another action. This action may utilize either linear or rotary motion.
- Once placed into motion, the machine must remain in constant motion (without human intervention) until the task is completed.
- Since mechanical steps are more in the spirit of a Rube Goldberg machine, **electrically powered steps will not be allowed**. However, electricity may be used to for lighting. This electricity must be supplied by commercially available batteries. The maximum total battery power allowed is 12 volts. For example: (8) 1.5 volt batteries, would equal a total of 12 volts.
- The machine must be designed and built during the current school year. No major part of a previous year's machine can be used.
- Each machine must be declared safe to operate by the judges. Any questionable items must be given prior consent by CPEP.
- Any loose or flying objects must remain within the set dimensions of the machine.
- A machine may not incorporate any live animal.
- Combustible fluids, explosives, open flames, or hazardous materials are not allowed.
- A machine must not imply profane, indecent, or lewd expressions.
- Each team is responsible for the security of its own machine. Intentional destructive action against other machines will result in disqualification.
- No machine may be taken down or disassembled until the contest is over.
- Students are responsible for removing their machine and related debris immediately following the CPEP contest awards.



Judging and Scoring

Each team will be given a 30 minute time period to set up and operate their machine. Within this time, teams must complete 3 successful cycles of their machine. Each machine will be scored on the amount of steps and simple machines that it incorporates and the average length of time required to complete a cycle. 10 points will be awarded for each simple machine or step that is used in the design **(maximum score of 100)**. The **average** time of 3 successful cycles will be added to this score. For example, if a machine incorporates 5 steps and 3 simple machines and has an average time per cycle of 34 seconds, the score would be 50 + 30 + 34 = 114.

Hint: To get the highest score, you want to design a machine that utilizes 10 simple machines/steps and has the longest possible running time.

HIGH SCHOOL CHALLENGE: RUBE GOLDBERG MACHINE

Core Outcomes:

Students will be able to point out and explain each simple machine that is incorporated in their project design. Students will be able to demonstrate the principles of potential energy, kinetic energy, and transfer of energy. Students will be able to give an example of the six simple machines: lever, inclined plane, pulley, gear, screw, and wheel & axle.

Challenge:

Construct a Rube Goldberg Machine that uses at least 10 steps or 10 simple machines, and takes the greatest amount of time to turn off a light switch.

Rules:

- **Dimensions:** The entire machine may not be larger than 24" (60.9cm) wide, 36" (91.4cm) long, and 60" (152.4cm) high. All machines must be displayed and operated at their assigned table which will be approximately 30" (76.2cm) high.
- **Number of Steps/Simple Machines:** The machine must complete its task in no fewer than 10 steps or 10 simple machines. However, the maximum number of steps or simple machines that will be scored is 20.
- Each step/simple machine must be **clearly** labeled in sequence.
- A step is considered to be an action that triggers another action. This action may utilize either linear or rotary motion.
- Once placed into motion, the machine must remain in constant motion (without human intervention) until the task is completed.
- Since mechanical steps are more in the spirit of a Rube Goldberg machine, **electrically powered steps will not be allowed**. However, electricity may be used to for lighting. This electricity must be supplied by commercially available batteries. The maximum total battery power allowed is 12 volts. For example: (8) 1.5 volt batteries, would equal a total of 12 volts.
- The machine must be designed and built during the current school year. No major part of a previous year's machine can be used.
- Each machine must be declared safe to operate by the judges. Any questionable items must be given prior consent by CPEP.

- Any loose or flying objects must remain within the set dimensions of the machine.
- A machine may not incorporate any live animal.
- Combustible fluids, explosives, open flames, or hazardous materials are not allowed.
- A machine must not imply profane, indecent, or lewd expressions.
- Each team is responsible for the security of its own machine. Intentional destructive action against other machines will result in disqualification.
- No machine may be taken down or disassembled until the contest is over.
- Students are responsible for removing their machine and related debris immediately following the CPEP contest awards.

Judging and Scoring

Each team will be given a 30 minute time period to set up and operate their machine. Within this time, teams must complete 3 successful cycles of their machine. Each machine will be scored on the amount of steps and simple machines that it incorporates and the average length of time required to complete a cycle. 10 points will be awarded for each simple machine or step that is used in the design **(maximum score of 200)**. The **average** time of 3 successful cycles will be added to this score. For example, if a machine incorporates 7 steps and 6 simple machines and has an average time per cycle of 45 seconds, the score would be 70 + 60 + 45 = 175.

Hint: To get the highest score, you want to design a machine that utilizes 20 simple machines/steps and has the longest possible running time.