Rube Goldberg
a design challenge exploring energy, work, and simple machines

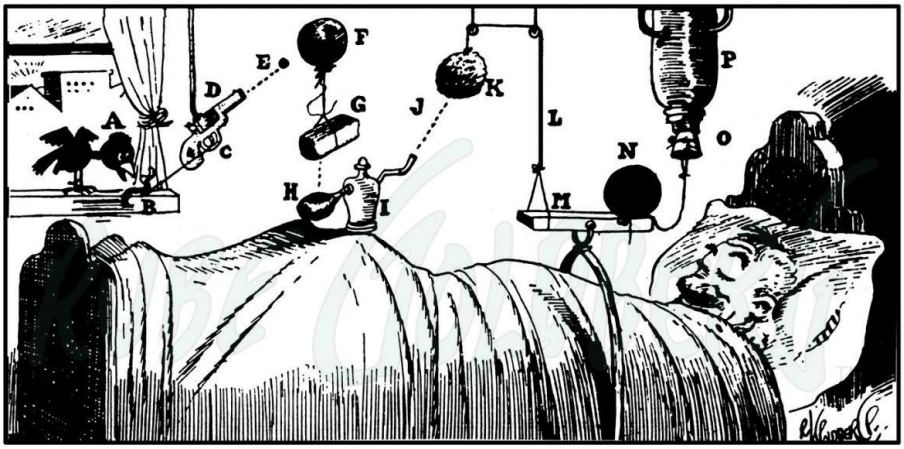
Question: Can you build a machine that will complete a simple task in on less than six energy transfers using at least three simple machines?

Knowledge Probe:
What types of energy exist? How does energy transfer?
What are the six types of simple machines?
What is work? How do machines make work "easier?"
What is power?

Rules
1. Machine must accomplish a simple task and have an appropriate name.
2. Machine size is limited to no greater than 3 feet by 4 feet by 5 feet, oriented any direction you wish.
3. You may work in pairs or in groups of three. If you work in pairs, your machine must execute at least six energy transfers. If you are in a group of three, your machine must execute at least nine energy transfers.
4. Machine must include at least three different and unique simple machines.
5. Machine must have TWO parts/objects that you have designed in TinkerCAD and 3D printed at school.
6. You can submit your completed machine by video (record your machine working in one continuous clip) or by building and physically demonstrating machine in class.
7. Machines will be judged for extra credit points as follows:
   a. Best overall theme or design
   b. Single most original energy transfer
   c. Most entertaining machine overall
8. Do NOT spend a lot of money on this. Use supplies found around the house such as toys, recyclables, blocks, sporting equipment, household utensils, etc. Use of commercially bought materials should be avoided and will negatively impact your project grade. Be creative!

Investigative Plan
1. In your notebook make a list of all materials needed to construct your machine.
2. Include a diagram of your machine similar to the Simple Alarm Clock diagram below. Teacher MUST approve BEFORE machine can be assembled. Be sure to label each simple machine used in the machine.

Simple Alarm Clock



The early bird (**A**) arrives and catches worm (**B**), pulling string (**C**) and shooting off pistol (**D**). Bullet (**E**) busts balloon (**F**), dropping brick (**G**) on bulb (**H**) of atomizer (**I**) and shooting perfume (**J**) on sponge (**K**)–As sponge gains in weight, it lowers itself and pulls string (**L**), raising end of board (**M**)–Cannon ball (**N**) drops on nose of sleeping gentleman–String tied to cannon ball releases cork (**O**) of vacuum bottle (**P**) and ice water falls on sleeper's face to assist the cannon ball in its good work.

Observations: In your notebook, record observations of three other groups' machines. Record which simple machines were used and the simple task the machine accomplished.

Data Analysis: Answer the following questions in your notebook in complete sentences:

1. In detail, explain the types of energy used by your machine and how the energy changed from one type to another during its operation.
2. Explain how each type of simple machine makes work easier.

Evaluation: In your notebook record a reflection/conclusion/summary paragraph answering the following questions:

1. What part/s of your machine worked best?
2. Which part/s did your team have the most trouble assembling or getting to work correctly?
3. How could you improve your machine?
4. How well did your team work together to complete this project?
5. Identify specific teamwork skills you used while completing this project. Describe how you used them.
6. How could you have been a better team member?

Grading:

Criteria	**Pts Possible**	**Pts Earned**
Includes at least 7/10 energy transfers	30	
Successfully accomplishes simple task	10	
Knowledge Probe	5	
Investigative Plan	15	
Observations	6	
Data Analysis	9	
Evaluation	15	
Total	90	
Extra Credit		
Best design/theme	5	
Most original energy transfer	5	
Most entertaining	5	