Name: _____

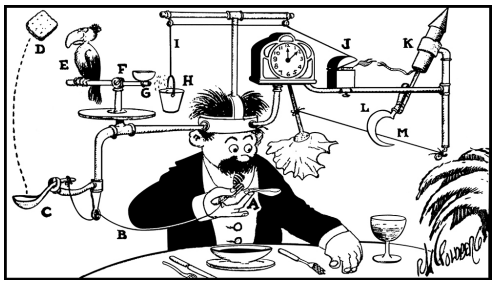
www.scienceinschool.org

Conservation and transfer of energy: project-based learning with Rube Goldberg machines

Assignment worksheet

Design project: Design a Rube Goldberg Machine

Cartoonist Rube Goldberg (1883–1970) was famous for his sketches of complicated contraptions designed to accomplish simple tasks, such as fetching a glass of water. His comical vision of engineering lives on. Every year in colleges across the country, teams of students participate in Rube Goldberg contests to design and build the most creative, complex, and amusing mechanisms possible to do simple jobs like hammering a nail or zipping a zipper. If you enjoy building a Rube Goldberg machine, perhaps you will find yourself at a national competition one day.



A comic of a self-operating napkin created by Rube Goldberg. Artwork Copyright © and TM or ® marks as All Rights Reserved. RUBE GOLDBERG ® is a registered trademark of Rube Goldberg Inc. All materials used with permission. rubegoldberg.com

Design challenge

Design and build a Rube Goldberg device accomplish a simple task.

Design constraints

Design (on paper), build, and refine a Rube Goldberg machine within the following constraints.

a. The initial step activates your machine. After release the device must operate without assistance.

b. It must use at least ***FIVE different energy transitions*** and the final transformation will perform the task of your choice

c. It must contain at least ***THREE unique simple*** machines.

d. You will record and upload the entirety of your machine.

Name: _____

www.scienceinschool.org

Suggested Materials

string, paper and cardboard, scissors, tape, paperclips, grooved rulers or tracks, aluminium foil, electricity kits (with batteries, bulbs, and wires), paper cups, straws, craft sticks, pulleys, electric motors (hobby size), old textbooks

Design sketch

On a separate sheet of paper, draw a schematic of your device. Number each step of its operation and include a brief description of each step in Table 1.

Input and output energies

When operating your device, make suitable measurements to calculate the ratio of the output energy to the input energy for ***EACH*** energy transfer.

1. Calculate the input energy. Either type the formulas or upload pics of your handwritten work.

Enter ONE calculation per box. Remember to **SHOW YOUR WORK** and **INCLUDE UNITS!!**	
1	
2	
3	
4	
5	

*add additional rows to the table if needed

Name: _____

www.scienceinschool.org

2. Calculate the output energy. Either type the formulas or upload pics of your handwritten work.

Enter ONE calculation per box. Remember to **SHOW YOUR WORK** and **INCLUDE UNITS!!**	
1	
2	
3	
4	
5	

*add additional rows to the table if needed

3. Calculate the ratio of output energy to input energy. Either type the formulas or upload pics of your handwritten work.

Enter ONE calculation per box. Remember to **SHOW YOUR WORK** and **INCLUDE UNITS!!**	
1	
2	
3	
4	
5	

*add additional rows to the table if needed

Name: _____

www.scienceinschool.org

Energy transformations and simple machines

You will be assessed on the number of energy transformations and/or transfers in your device and your ability to identify the simple machines used in the design. For each step listed below, in Table 1, record the types of energies involved, and any simple machines used in that step. For example:

Step 1) Ball rolls down ramp: $E_{p\_\,gravitational}$ to E_k and $E_{rotational}$

Table 1: Rube Goldberg machine

Step	Description of step	Energy transformations	Simple machines
EX	Describe what is happening in your machine	$E_{P\text{-}gravitational}$ to E_K and $E_{rotational}$	Lever, pulley, screw, wheel & axle, inclined plane, or wedge
1			
2			
3			
4			
5			
6			
7			
8			

*add additional rows to the table if needed