

PaperBot Series

Rube Goldberg Activity

Subject: Science & Technology

Grade Level: 3 - 5

Topic: Design and build a Rube Goldberg machine to emphasize practical use of mechanisms.

Activity Time: 2 hours

Goals	Students will be able to: <ol style="list-style-type: none">1. Understand different forms of energy and methods to start energy transfer.2. Successfully implement mechanisms to achieve a final goal.3. Communicate design ideas and system requirements clearly to other students.4. Manage time and group interactions to obtain objective within set timeframe.5. Address a technical problem from multiple perspectives.
Objectives	Create a Rube Goldberg machine using common classroom materials that will allow for one marble to start the machine and will finish by having one marble enter a cup in a specified location.
Materials	Newspaper, paper, cardstock, straws, rubber bands, paper clips, masking tape, string, pens/pencils, scissors, desks/chairs, other materials/products in classroom
Introduction	Introduction topics: <ol style="list-style-type: none">1. Design cycle2. Teamwork and project management3. Energy and energy transfer techniques4. Mechanisms
Procedure	<ol style="list-style-type: none">1. Tape 4'x4' squares on the floor in one of the Suggested Group Layouts.2. Introduce activity and required information topics (~10 minutes)3. Split students into teams of two or three and assign to a square.4. Teams will meet and brainstorm about possible designs to use for their space. (~ 5 minutes)5. All teams for the group layout will reconvene and discuss the plans for the overall system design. Attention should be given to principles that plan to be used, which materials should be utilized, and the input and output requirements for each square. (~ 10 minutes)6. Individual teams will break off and begin the design, build, and iteration process. (~ 30 minutes)7. Reconvene the group. Each team should present to the group their plan for the square and their current status. Students should also bring attention to any problems they are accounting. Teams should give feedback on the design and status of other teams in their group. (~5 minutes)8. Teams will continue their build/iteration process. (~ 30 minutes)9. Perform a final system wide test. Leave time for minor adjustments to design. (~ 5 minutes)10. Wrap-up activity with discussion about methodologies used and lessons learned. (~ 15 minutes)
Wrap-up	Suggested discussion points: <ol style="list-style-type: none">1. What existing designs/technology did you draw from? How?2. What energy principles did you use? How?3. What problems did you encounter in the design process? How would you address these problems in the future?4. Describe how you planned your time in order to meet your goals?

PaperBot Series

Rube Goldberg Activity

	<ol style="list-style-type: none">5. What team structure was used? What information did you communicate to other groups?6. What did you learn from this exercise? How can this be translated to the real world?
--	--

Educational Standards:

Massachusetts State Standards for Educational Framework – Science – Grade 5

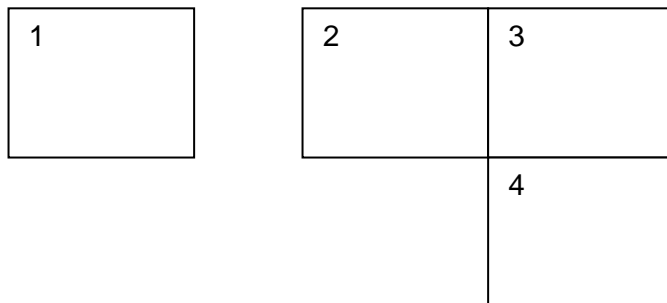
- MA.SIS.1 → Ask questions and make predictions that can be tested.
- MS.SIS.4 → Conduct multiple trials to test a prediction. Compare the results of an investigation or experiment with the prediction.
- MA.SIS.5 → Recognize simple patterns in data and use data to create a reasonable explanation for the results of an investigation or experiment.
- MA.SIS.6 → Record data and communicate findings to others using graphs, charts, maps, models, and oral and written reports.
- MA.PS.4 → Identify the basic forms of energy (light, sound, heat, electrical, and magnetic). Recognize that energy is the ability to cause motion or create change.
- MA. PS.5 → Give examples of how energy can be transferred from one form to another.
- MA.T/E.2.3 → Identify relevant design features (e.g. size, shape, weight) for building a prototype of a solution to a given problem

PaperBot Series

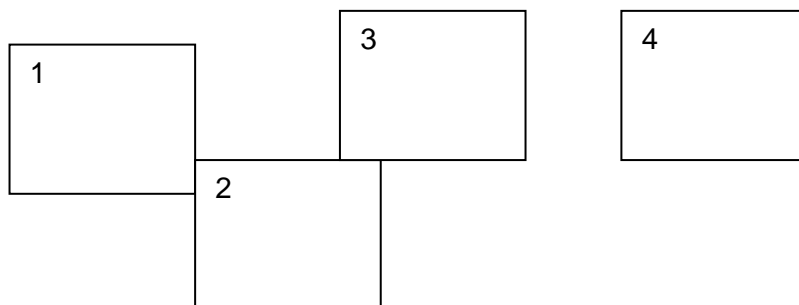
Rube Goldberg Activity

Suggested Group Layouts

Suggested Group Layout 1:



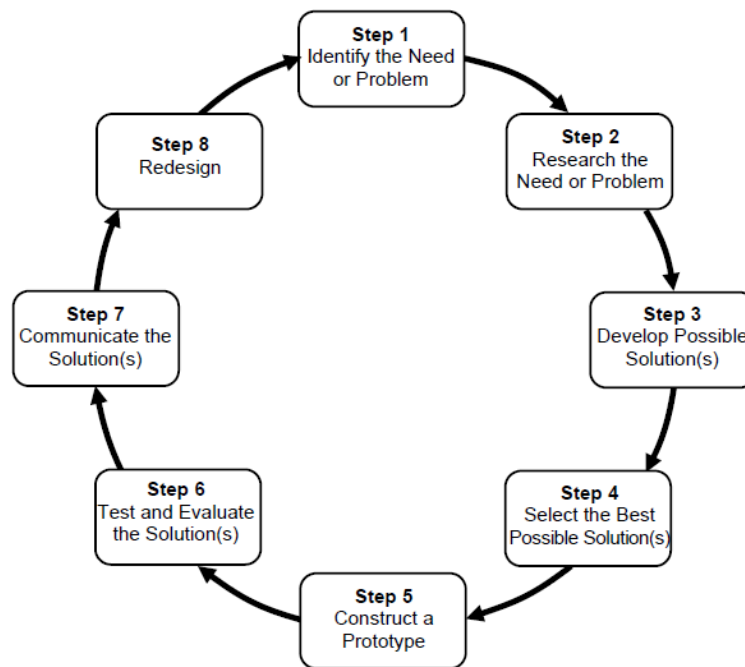
Suggested Group Layout 2:



PaperBot Series

Rube Goldberg Activity

Steps of the Engineering Design Process

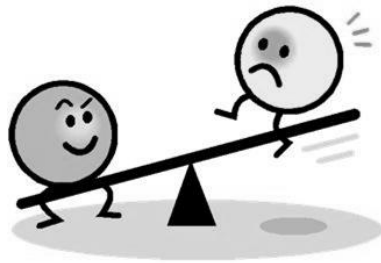


1. Identify the need or problem
2. Research the need or problem
 - Examine the current state of the issue and current solutions
 - Explore other options via the Internet, library, interviews, etc.
3. Develop possible solution(s)
 - Brainstorm possible solution(s)
 - Draw on mathematics and science
 - Articulate the possible solution(s) in two and three dimensions
 - Refine the possible solution(s)
4. Select the best possible solution(s)
 - Determine which solution(s) best meet(s) the original need or solve(s) the original problem
5. Construct a prototype
 - Model the selected solution(s) in two and three dimensions
6. Test and evaluate the solution(s)
 - Does it work?
 - Does it meet the original design constraints?
7. Communicate the solution(s)
 - Make an engineering presentation that includes a discussion of how the solution(s) best meet(s) the initial need or the problem
 - Discuss societal impact and tradeoffs of the solution(s)
8. Redesign
 - Overhaul the solution(s) based on information gathered during the tests and presentation

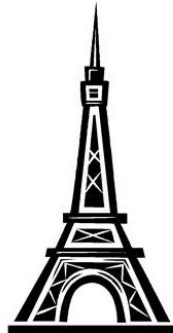
PaperBot Series

Rube Goldberg Activity

Lever Examples



Structure Examples



Energy Examples

