

Rube Goldberg Machine

A Rube Goldberg machine is a machine invented by Reuben Garrett Lucius Goldberg, whom was an American cartoonist, sculptor, author, engineer, and inventor. A Rube Goldberg machine is basically a machine that does a simple task, but in an overreacted and exaggerated way. One of Goldberg's cartoons which featured a Self-operating napkin, shows that Professor Butts (the man in the picture) has created a machine that operates to wipe his mouth, but in an excessive way. Our goal here in KIS is also to make our own Rube Goldberg machine, as a part of DCC (Design Cycle Challenge week.)

During this DCC week, Team 14 will be creating a Rube Goldberg machine. The Rube Goldberg machine will be start and end with dominoes, and the machine will help trigger and transfer a marble to impact with other dominoes. Our machine will also represent our team idea (art), therefore we decorate our work with various colours of tape and paper, to represent our team theme.



The concept of building a Rube Goldberg machine is fairly simple, but it looks complicated. With the constant reaction from a drop of a marble, to the fall of a domino, or a tug of string, it can cause a chain reaction which looks complicated but made up of various actions which all comes together as one machine; the Rube Goldberg machine.

The Rube Goldberg machine was created to do simple tasks but in very complicated ways, in a chain reaction. The chain reaction usually uses two type of energy, Potential energy and Kinetic energy to help it transfer and move from one part of the machine to the other. Potential energy is a type of energy where you drop the object, which then makes kinetic energy when it impacts the ground.

Question: How can we use the physics concepts to create a complex machine to perform simple task(s)?

Design

- 1) The machine will have atleast three "Action"
- 2) The machine will have atleast two areas where potential energy occur
- 3) There will be atleast three Rube Goldberg machine designs
- 4) There will be atleast one working Rube Goldberg machine
- 5) The final product must relate to the visual stimulus (paint and color)
- 6) The final product must be made using all of the dominoes (50)
- 7) The machine must be painted using at least 4 colors

Specification/test statement

Design

- 1) We will go through the designs and ask the teacher to verify our products. We will test our machine more than once to make sure that there are three actions.
- 2) We will include at least two dropping and falling objects from a certain height
- 3) We will upload the photos of the designs and include it in the report
- 4) We will ask the teachers for suggestions and feedbacks for our designs. We will also do some tests and come up with three designs.
- 5) We will paint the machine and ask our supervisors if it relates to the image.
- 6) We will count the number of the dominoes used for our final product
- 7) We will qualitatively observe the colors of the machine

Specification test

During this design cycle challenge, we had a chance to create our own Rube Goldberg machine in groups. This design cycle is very challenging because it challenges us to apply our understanding of physics concepts to create a multi-step machine that connects with the nearby groups' Rube Goldberg machines. This DCC requires us to include three actions and two areas where potential energy occur. Most of our designs connects to the physics concepts because there are rolling marbles and toppling dominoes. At the beginning of the week, an image, or the visual stimulus was assigned to each group. The goal is to create a functional Rube Goldberg machine that's related to the image. The image assigned to our group is likely to be

paint and colors or art. Our objective is to paint our Rube Goldberg machine with many colors (such as orange, red, yellow and blue) and/or to stick many colored papers to make it look colorful like the image. Painting our Rube Goldberg machine could represent the principle of the visual stimulus which is the unity and harmony of paints and colors. Painting our Rube Goldberg could also relate to the principle of our visual stimulus because it would represent the balance, proportion, pattern and scale of the art and painting. From the tests we did with the designs, we discovered a couple of successful designs. I'm confident that we learned from our mistakes and made adjustment and changes to our designs.

On the 12th November, Our group had a brain storm and came up with our first design. We planned to make this Rube Goldberg machine start with toppling dominoes to make it easier to connect with group 14's machine. The first section of the machine would be made by using 10-20 dominoes and 6-7 books. We placed the books into inclining layers like a stair case after 8-10 dominoes. We then place a domino on the edge of each book. The second section of the first design would be made by using a grooved wheel, a PVC pipe, a marble, a domino, clay, tape, two paper cups and strings. First, vertically stand the PVC pipe next the book stair case, then use tape and clay to make the PVC pipe stand and sturdy. This is one of the action we include in the design, by using the material to make a pulley. Second, wrap a rope around the grooved wheel, and stick two paper cups to both side of the rope. Third, attach the grooved wheel horizontally (side ways, or aligned to the direction the book stair case is heading) to the top of the PVC pipe, use tape to stick it on. Fourth, cut the side of the paper cup on the left side of the PVC pipe. Fifth place the marble inside the left cup and a domino on the edge of the book on the highest layer. The third section would be made the same as the first section, but with a PVC pipe cut into a rack. What would happen is the dominoes would start toppling from the start and topple the dominoes on the book stair case. The last domino will then be topple into the right paper cup which would lift the left cup with the marble in it up. The marble will then roll down the rack, hit the domino on top of the book stair case and topple the rest of the dominoes like the beginning, but opposite direction (downward).

Designs

We have three designs that we have created, each one developing from the first and original idea.

Design #1

Our first design consists of various materials, like dominoes, wood, future board, and many more. You can view our design (drawn) on our video by [clicking here](#). Our first design was fairly complicated, since it has various parts in a machine such as a weight, which when the marble falls into one cup the other cup will lift up which will continue to trigger other things. There are other complicated contraptions which are supposed to be in our design, but since they didn't work out well we decided to eliminate them.

Design #2

Our second design still had dominoes at the start and the end of the machine, although we added new tricks such as using string to remove the barrier which was blocking the marble, and also made something which looks similar to a pinball game, with walls that control the marble to move down slowly (if placed at a slanted angle). You can watch our video and Mint explaining [here](#). For our construction we decided to use more future board, and glue them together using stronger, hot glue from the hot glue guns to make it sturdier.

Design #3

Our third and final design is mostly based of Design #2, since there were many successful areas which we could improve on. It is almost exactly the same as Design #2, although we painted the dominoes (which are relevant to our theme; art and colour) and we added a spiral to our machine, and bumped the height up with a chair. You can watch the video of Mint explaining the construction [here](#).

Guy
and
BB
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The final design that we chose is Design #3, because it was the design which worked the best with other groups, and had completed all tests for the expectations. Firstly, our Rube Goldberg machine is colourful, which represents our theme (art and colour). (See image to the right)



Our dominoes were painted in various colours which gave it a radiant look to our design, which also made our machine look really cute, colourful, and playful. We decided to use paint, instead of paper, mostly because paint was easier to apply onto the wood, but also because of the team's idea/theme which is paint and colour.

Process Photos



BB and Guy
painting dominoes



Some of the
finished dominoes



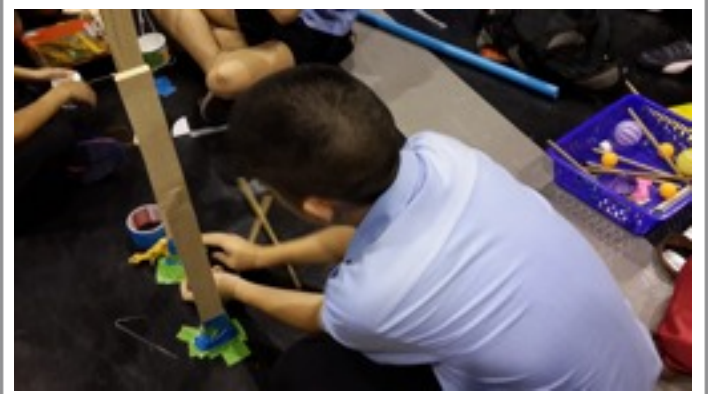
Penny painting the dominoes



Aya painting the dominoes



Penny working on the first design



M working on the first design



Mint glueing the future board for the second design

Evaluation

Our team has made many changes to our machine since the first design. The first design was made to have many different types of contraptions which were using plenty of potential energy, and were all copies of the things we've seen online. The second and third design was more based on what worked and what didn't, to help move the marble and the dominoes smoothly throughout the activity. Our team had to test the machine many times for it to work smoothly, although even in the final event where everyone's Rube Goldberg machines were connected with each other, our machine worked three out of the five times (without help) and that was great!

There were many things we could have improved, such as the design itself and improving upon the little details which we could have added. Our design compared to other groups were really simple, although it was consistent (Afterwards, on the last day it worked almost all of the time), it wasn't outstanding. Rube Goldberg machines were supposed to be a complex design to accomplish something simple, and so far I've noticed, our design isn't really complex. It isn't very exaggerated, and it (compared to other groups) looks like much effort hasn't been put into it. Overall it looks great, and our teamwork was pretty well overall, since every member collaborated (Our tenth grader, M, even though he wasn't here for a day he still contributed to working on the report!)



Work Cited

"Amazing Rube Goldberg Machine."YouTube. YouTube, 01 Nov. 2007. Web. 14 Nov.

2013.

<<http://www.youtube.com/watch?v=H30zTv406Mo>>.

"Designer Blog."Designer Blog RSS. N.p., n.d. Web. 14 Nov. 2013. <<http://>

99designs.com/designer-blog/2012/05/11/back-to-basics-part-ii-principles-of-design-with-painting/>.

"Motion (physics)."Wikipedia. Wikimedia Foundation, 14 Nov. 2013. Web. 14 Nov. 2013.

<[http://en.wikipedia.org/wiki/Motion_\(physics\)](http://en.wikipedia.org/wiki/Motion_(physics))>.

"Quizlet."7 Types of Simple Machines Flashcards. N.p., n.d. Web. 14 Nov. 2013. <<http://>

quizlet.com/12552322/7-types-of-simple-machines-flash-cards/>.

"Rube Goldberg Project." N.p., n.d. Web. 15 Nov. 2013. <[http://thescienceguru.com/wp-](http://thescienceguru.com/wp-content/uploads/2011/06/Rube-Goldberg-Project.pdf)

[content/uploads/2011/06/Rube-Goldberg-Project.pdf](http://thescienceguru.com/wp-content/uploads/2011/06/Rube-Goldberg-Project.pdf)>.

Six Rube Goldberg Machines."YouTube. YouTube, 26 May 2009. Web. 14 Nov. 2013.

<<http://www.youtube.com/watch?v=dFWHbRApS3c>>.

"What Is Potential Energy."What Is Potential Energy. N.p., n.d. Web. 14 Nov. 2013. <<http://>

www.tjhsst.edu/~jleaf/tec/html/10/potent.htm>.

"Newton's Laws of Motion."Physics4Kids.com: Motion: Laws of Motion. N.p., n.d. Web. 14

Nov. 2013. <http://www.physics4kids.com/files/motion_laws.html>.