

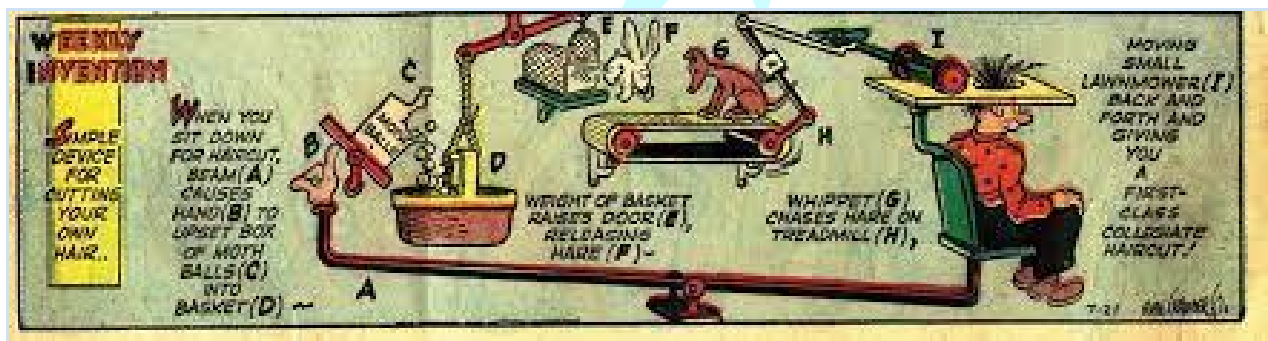
Build a Rube Goldberg Machine

Competition Category: Design Challenge

The **Design Challenges** are events in which the child solves a design problem using the Design Thinking Cycle. The design problems range from a wide variety of areas.

This version of **Design Challenge** is to **Build a Rube Goldberg Machine**.

Introduction



Everytime something moves, heats, cools, or explodes, some form of energy is transferred from one piece of matter to another. Since there are many different forms of energy, there are different ways to transfer it. This challenge is designed to let you demonstrate your understanding of those transfers by creating some of your own.

Rube Goldberg was a cartoonist, inventor, and engineer who is famous for drawing cartoons that depict overly complicated machines that perform very simple tasks using the concepts of energy transfers. The [Rube Goldberg Machine](#) is a combination of several simple machines connected together to make a complex machine. It is a chain reaction type machine or [contraption](#) intentionally designed to perform a simple task in an indirect and fantastically complicated way. Usually, these machines consist of a series of simple unrelated devices, the action of each triggers the next, eventually resulting in achieving a stated goal.

In this challenge teams are going to create a similar machine that uses many transfers of energy to do one simple task. Children can collaborate with parents to work as engineers to solve the problem. Engineers gather information that might include the constraints or limitations on the problem, such as materials or time or safety, to propose a solution. Similarly working with the constraints the participating teams will have to come up with different energy transfer ideas using simple machines to accomplish the final task. Also we have to be mindful that our contraption is safe.



Challenge Description

The task is to **design and construct a RubeGoldberg machine** using at least 4 simple machines from pulley, lever, wedge, screw, wheel and axle, inclined plane and at least 3 energy transfers to successfully complete an "end task" using a minimum of 15 steps.

Goal: The End Task can be any one of the following:

- Pour water into a cup
- Put coins in piggy bank
- Roll the dice
- Pops a Balloon
- Roll the ball into a tumbler
- Golf ball in a hole

Children will use their creativity to design and build a fun and exciting machine!

In this challenge teams will be making a sketch of the proposed design. Then using **the material available at home you can implement the proposed design**. The model of the machine can then be tested and improvised if required. Teams are supposed to record a video of the working prototype and upload it on the **Makershala Portal**.

When you are brainstorming your idea, think about the following:

- What are simple machines?
- How do they work?
- How to use a simple machine to design a more complex/compound machine?
- What is kinetic energy? What is its role in the machine?



After taking up this challenge, students will be able to

- Explain energy transfers
- Identify different types of simple machines and mechanisms.
- Explain the nature of a Rube Goldberg machine.
- Recognize the use of mechanisms in everyday life.
- Demonstrate skills like teamwork, reasoning and problem solving.

Competition Timeline

- 11th March: Challenge opens
- 26th March Registration Closes
- 28th March: Video Submission closes
- 3rd April: Results announcement

Materials Required

- Cardboard (cereal box, shoe box, cardboard panels, etc.)
- Tubes (cardboard, plastic, insulation tubes, etc.)
- Paper, plastic, aluminum foil
- Disposable cups, any size
- Soda or water bottles or cans
- Funnels
- Wooden dowels, craft sticks, chopsticks, skewers, plastic cutlery
- Building blocks
- Ruler
- Balloons
- Bells
- Dominoes
- Fan
- Ice cubes

Options for materials that connect parts:

- Types of tape
- Glue (a hot glue gun works well)
- Rubber bands
- Thread

Options for materials that roll:

- A variety of balls of different masses, like marbles, ball bearings, ping pong balls, tennis balls, pool balls, etc.
- Toy cars



Rules & Regulations

- A Rube Goldberg Machine is designed such that a single action STARTS the machine, such as pressing a button, letting go of a marble, cutting a string, removing a barrier, etc. No other additional human actions should be required once your machine has started.
- The use of items in your machine must be different from their original functions. In a Rube Goldberg Machine a scissor is not used to cut, ball is not used to play, spoon is not used to eat. So be creative and resourceful. You do not have to spend money to create a great machine just use your imagination.
- Participants are advised to choose the material available at home, some of the material is suggested in the material list for reference. It is recommended to refer to the list of materials but is not mandatory.
- The machine must have a minimum of 15 steps. There is no limit to the maximum number of steps.
- A minimum of 4 simple machines must be present. Choose from a wheel and axle, a pulley, an inclined plane, a wedge, a lever, and a screw. Please note using a screw to hold something together does not count as using a simple machine. Rather, the simple machine must be used as a part of a step.
- The machines should be no larger than **4' x 4' x 4' (feet)**.
- Your project must have a minimum running time of **30 seconds**, and a maximum run time of **3 minutes**. The machine must complete a full cycle in no more than 3 minutes. A full cycle includes a first run to completion of the task.
- A machine should not incorporate any live animals.
- Each machine must be safe.
- The machine must complete the final task.
- No corporate logos or names may be displayed on the machine
- Any loose or flying objects must remain within the set boundaries of the machine. This includes, but is not limited to, drops of water, balloon, and other “small” objects. Steam and other gasses are exempt from this rule.
- Any electricity used must be battery power.
- No flames, hazardous materials or explosives can be used on the machine.
- There will be step marking only if the final task is accomplished.

Challenge Submission:

- Click a picture of the Sketched idea and upload on the Makershala portal
- Record a video of the Working Model of the complete Run and upload on the Makershala Portal.

Video recording instructions

Video has to be recorded keeping the entire model in frame.

The recording should be done in the Landscape mode.

All the elements should be visible and sounds should be audible.



How to Count Steps

One step is defined as one action/reaction or an energy transfer. Each step may incorporate things like pulleys, levers, ramps, electrical switches, batteries, dominoes, catapults, etc.

Each step/energy transfer must be clear so that the jury can see and understand your steps. Hence, this is a very important component to your project.

Example:

- A ball crashing into a set of dominoes transfers its kinetic energy to the dominoes.
- The falling dominoes trigger a mouse trap
- The mouse trap launches a block of wood into a cup
- The extra weight in the cup presses down on an electrical switch completing a circuit.
- The completed circuit turns on a fan which pushes a sailboat.

Kindly refer to the link given for more details: <http://mousetrapcontraptions.com/cool-machines-3.html>

Evaluation Criteria

Teams will be building and testing the Rube Goldberg Machines, recording their videos and submitting. The Models will be evaluated on following criteria.

- Machine Types used (Includes 4 different simple machines, repetition is allowed but will not be counted separately)
- Machine Process applied (the steps must be distinct and must not appear as blended together)
- Energy Transformations (Machine uses 3 energy transformations)
- Number of steps (should be at least 15)
- Reliability (Machine should run reliably, without human intervention)
- Task executed (on the completion of run, task is accomplished)
- Creativity (A novel and amusing idea, not a straightforward implementation.)
- Run time (should be max i.e.3min)

Rewards

- **First Prize:** The team with the best Rube Goldberg Machine will be rewarded with First Prize. Rs. 2000/- DIY Kits Voucher, First Position Certificate.
- **Second Prize:** The team with the second-best Rube Goldberg Machine will be rewarded with Second Prize. Rs. 1000/- DIY Kits Voucher, Position Certificate.
- **Third Prize:** The team with the third-best Rube Goldberg Machine will be rewarded with Third Prize. Rs. 1000/- DIY Kits Voucher, Position Certificate.
- **Most Creative:** One team with the most unique machine will be rewarded with the Most Creative Design Prize. Rs. 1000/- DIY Kits Voucher, Category Certificate.
- **Certificates for all the participants**
- **10% discount on Makershala Program for all participants**
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Tutorials & Help Text

Once registered, the participants will be able to access the Challenge Guidelines and help text through the Makershala Portal or Makershala Learn App only after 24 hrs from the time of registration. The submissions are to be made on the platform itself. You can login to the platform with the credentials shared on the mail. You can also download the Makershal Learn App for iOS or Android from Apple Store and Google Play Store respectively. Below given are the download links:

- iOS: <https://apps.apple.com/in/app/makershala-learn/id1594348811>
- Android: <https://play.google.com/store/apps/details?id=com.makershala.learn>

A few inspirations to start with

- ▶ How To Build a Rube Goldberg Machine
- ▶ Design and Build a Rube Goldberg
- ▶ Red Ball Adventure
- ▶ KiwiCo Marble Run Challenge
- ▶ Tutorial | DIY Rube Goldberg

Keep Practicing to Build the Rube Goldberg Machine! We are waiting to see your Machines!

Happy Making,

Makershala