

## Create your own Rube Goldberg Machine! (Level 2)

<b>Description</b>	Teach your learners the principles of engineering and the values of resilience, creativity, and attention to detail with this hands-on activity
<b>Leading Question</b>	How can we create a machine that helps us do something useful or fun in our house?
<b>Total Time Required</b>	50-80 minutes per day over 3 days.
<b>Supplies Required</b>	Pencil, color pens, paper/notebook, household items to create the machine (ball, toy car, Legos, tape, straws, cards, dominoes, strings, etc. - any items found at home)
<b>Learning Outcomes</b>	<ol style="list-style-type: none"> <li>1. Understanding of motion and force.</li> <li>2. Understanding of an example of a machine that uses force to work.</li> <li>3. Design and execution of a machine.</li> </ol>
<b>Previous Learning</b>	Basic understanding of force and motion strand (G1 science)

### DAY 1

Today you will learn about what makes things move, and watch videos of a Rube Goldberg machine.

<b>Suggested Duration</b>	<b>Activity and Description</b>
<b>10-20 minutes</b>	<p>Discussion:</p> <ul style="list-style-type: none"> <li>• What is motion? <ul style="list-style-type: none"> <li>○ Let the learner reflect and answer. They may refer to their science textbook</li> <li>○ Explain that motion is when something moves from one place to another</li> </ul> </li> <li>• How do things move? The learner will stand up and act out how these objects move:</li> </ul>



- Do these objects move on their own?
  - Let the learner reflect and answer
  - Explain that some objects (like people and animals) move on their own, while others (cars and trolleys) need someone to push or start them. This is called force.
- What is a machine?
  - Let the learner reflect and answer
  - A machine is something that is designed to make our work easier. Give them examples: wheels, scissors, cars are all different types of machines
- Do machines move on their own? How does a bicycle move?
  - Let the learner reflect and answer
- Explain that a bicycle works to move us from one point to another by applying force to the pedals

**5-10 minutes**

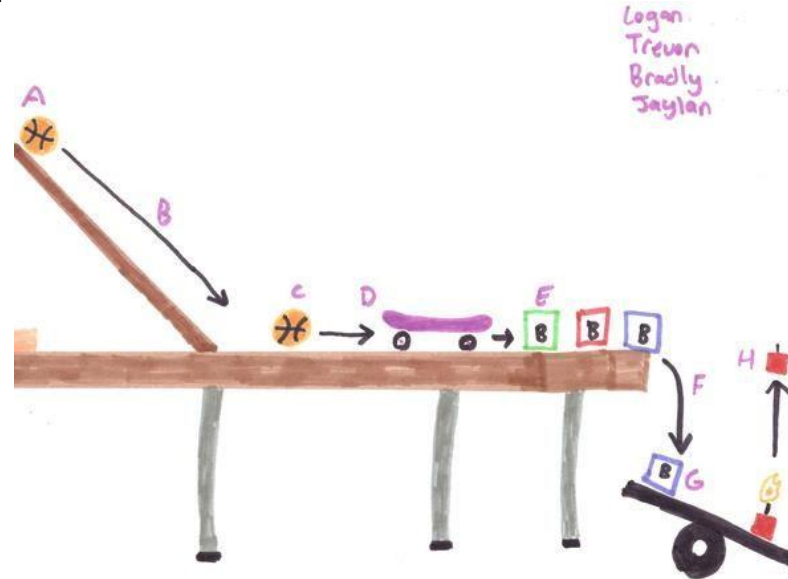
- Watch some videos Rube Goldberg machines online to get the learner excited about building their own. If you do not have access to the internet, you can show them one of the images below:

To secure coins:

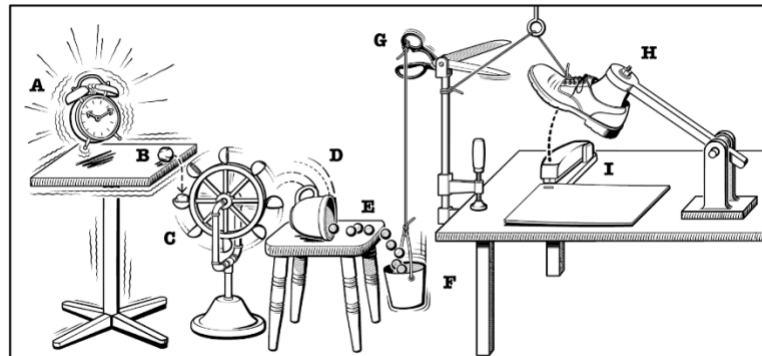


Source:

To put out a candle:



To staple paper:



To spray a piece of cloth:



<b>5 minutes</b>	<ul style="list-style-type: none"> <li>Discussion Do you know what type of machine the Rube Goldberg one from the video you just watched/image you have just seen is? Explain that a Rube Goldberg machine is a compound machine that is designed to “solve a problem” (such as pressing a button), and is composed of several simple and compound machines that are connected to each other such that exerting force on the first component to “start” the machine results in the exertion of force on the next component and so on until the last component is struck. You may provide this explanation after the next activity (discussion about machines)</li> </ul>
<b>15 minutes</b>	The learner will discover some machines at home! Tell them to spend some time walking around the house collecting 5-10 machines and to place them on a table
<b>20-30 minutes</b>	<ul style="list-style-type: none"> <li>After all the machines are placed on the table, ask him or her to write down in a notebook or piece of paper: Name of machine Why they think this is a machine What work does it make easier for us to do How it works If it is a simple or compound machine.</li> </ul>

## DAY 2

Today you will design your own Rube Goldberg machine!

<b>Suggested Duration</b>	<b>Activity and Description</b>
<b>2 minutes</b>	<ul style="list-style-type: none"> <li>Explain that the learner will be creating their own Rube Goldberg machine at home! Tell him or her that a Rube Goldberg machine must meet the following criteria It should have many small parts arranged close to each other</li> <li>It must do something at the end – like ring a bell, push a button, etc.</li> </ul>
<b>20-30 minutes</b>	<ul style="list-style-type: none"> <li>The learner will reflect on the type and purpose of the machine they want to make. They can watch more videos if needed to get inspiration. Ask him or her to draw the machine they want to build in their notebook or on a piece of paper using a pencil. A machine to put sugar in tea, made of a small pall, a few wooden popsicle sticks and a cup with tea at the end.</li> </ul>

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	<ul style="list-style-type: none"> <li>• A machine to pop a balloon made of a small ball, toy car/light stone with a pin attached, a wooden plan or popsicle sticks and a balloon at the end.</li> </ul>								
<b>20 minutes</b>	<ul style="list-style-type: none"> <li>• Using a similar list to the template below, the learner will gather all their toys or objects found in the house and write down what they think they can use in each category. Examples: balls, sticks, paper, ruler, bottles, bottle caps, cards, stones, candles, threads, pins, balloons etc. You can use any items you have at home or create ones out of paper or other easily adaptable material. The learner will then divide the items based on whether they roll, slide, pull etc.</li> <li>• Template:             <table border="0" style="margin-left: 20px;"> <thead> <tr> <th style="text-align: left;">Item</th> <th style="text-align: left;">Role</th> </tr> </thead> <tbody> <tr> <td>Ruler</td> <td>To be the ramp/course for the ball to roll on</td> </tr> <tr> <td>Ball</td> <td>To slide down the ramp and knock off the cards</td> </tr> <tr> <td>Cards</td> <td>To be knocked off by a ball and fall on something else</td> </tr> </tbody> </table> </li> </ul>	Item	Role	Ruler	To be the ramp/course for the ball to roll on	Ball	To slide down the ramp and knock off the cards	Cards	To be knocked off by a ball and fall on something else
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## DAY 3

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Today you will assemble and create your own Rube Goldberg machine, and then refine your machine so that it works perfectly!

<b>Suggested Duration</b>	<b>Activity and Description</b>
<b>10-20 minutes</b>	<ul style="list-style-type: none"> <li>• Time to test our design! The learner will assemble all the items, allow her or him to set up and test a part of the machine, e.g. a toy car with a pin taped to the top sliding down a ramp made of popsicle sticks and popping a balloon.</li> <li>• You can also create some items using paper or other adaptable material, if some items are unavailable</li> </ul> <p>After the setup is complete, ask them to get the machine going and observe what happens together</p>
<b>10-20 minutes</b>	<ul style="list-style-type: none"> <li>• Discussion:             <ul style="list-style-type: none"> <li>What do you think worked?</li> <li>What did not work?</li> </ul> </li> <li>• What can you change?</li> </ul>
<b>5-10 minutes</b>	<ul style="list-style-type: none"> <li>• Give them feedback and ask them to refine their design and items list either to fix errors or expand the machine (by adding just one or two additional parts. Do not complicate the design)</li> <li>• If the learner did not get it right this time, explain that designing a machine is a process and making mistakes is a part of it. Explain</li> </ul>

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	that this is the purpose of testing, so we can learn from our mistakes and make things work better.
<b>5-10 minutes</b>	<ul style="list-style-type: none"> <li>The learner will assemble all the items necessary and set up the modified machine for another testing round of the final design presented to the rest of the family!</li> </ul>
<b>5 minutes</b>	<ul style="list-style-type: none"> <li>Discussion:           <ul style="list-style-type: none"> <li>What do you think of your final design?</li> <li>What do you think worked?</li> <li>What didn't work?</li> </ul> </li> <li>What can you change?</li> </ul>
<b>10 minutes</b>	<ul style="list-style-type: none"> <li>The learner will make the necessary adjustments (if any) and set up the machine again to show their siblings/rest of the family! They will first explain the purpose of the machine, its different parts, and finally set it off!</li> </ul>
<b>5 minutes</b>	<ul style="list-style-type: none"> <li>The learner will present the set up and start the machine again in front of the rest of the family!</li> </ul>

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## ASSESSMENT CRITERIA

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- Successful creation of a Rube Goldberg machine that consists of 5 or more simple and/or compound machines, and that solves some problem/serves some purpose.
- Reiteration of design based on feedback.
- Presentation of final design.

## ADDITIONAL ENRICHMENT ACTIVITIES

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- There is always room for extending the complexity of the final design by adding more items.
- Older learners can also be asked to write a report documenting the process of creating the machine and detailing the types of component machines used, their operation mechanism, etc.