Rube Goldberg Challenge

| **Subject:** Physics  **Related Subjects:** Engineering | **Grade Level(s):** 3-8th  **Length of Lesson:** Month Long | **Type:** Inquiry / Design / Project  **Keywords:** Simple machines |
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# Lesson Overview

*Students learn the applications of physics by developing a Rube Goldberg machine over the course of a month.*

# Lesson Focus

They will be learning simple machines and will be reviewing their design process throughout the course of the month. Students should be revising their design to see what works and what doesn’t work for them and end up developing a model to share with the class.

| Lesson Objective(s) | By the end of this lesson, students will…   1. Understand simple machines and pulleys 2. Build a Rude Goldberg Machine using simple machines |
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# Lesson Timing

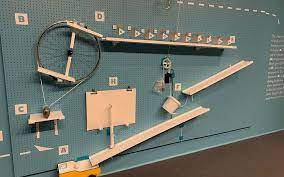
| Week 1 | Introduce the Lesson + go over simple machines + levers and start drafting design throughout the week + design review before starting |
| --- | --- |
| Week 2 | Build + Redesign |
| Week 3 | Build + Redesign |
| Week 4 | Reflection + Show and Tell |

| Materials | * Hot glue/super glue * Construction paper (10 per student) * Marbles * Small Paper cups * Paper towel tubes * String * Rubber bands * “Lab” notebook * Dominos * Wire * Yarn * Paper cups * Paper plates * Masking/Clear tape * Popsicles * Hooks |
| --- | --- |
| Teacher Prep | 1. Provide students with lab notebooks to record the design process 2. Survey the students during week one to see what materials the students would like to use (week one will be used for designing) materials should be bought based on the list and what students would like to be using 3. Introduce students to simple machines and levers |
| Related Resources | * <https://betterlesson.com/lesson/639055/rube-goldberg-challenge> * <https://www.teachengineering.org/activities/view/cub_simp_machines_lesson05_activity1> * <https://www.teachengineering.org/lessons/view/cub_simp_machines_lesson05> * <https://www.thescienceacademystemmagnet.org/2020/05/19/rube-goldberg-machines-compilation/> * <https://docs.google.com/presentation/d/1Sweu9ZBOGY1twDV7J0w1gqD6MVyms3EGwzN-M1hsJlA/edit?usp=sharing> |

# Lesson Plan

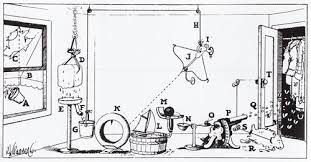
## Introduction -- in class

*Introduce students to the learning goals and make connections to past and present learning experiences. Stimulate interest and prompt students to identify their own questions about the topic. This can link the lesson to real world examples, introduce associated STEM careers, and assess their prior knowledge on the topic*

1. What is the Rube Goldberg Machine?
   1. The phrase Rube Goldberg Machine became popularized after an American cartoonist drew a chain reaction-type machine, to perform a simple task in a complicated way. The machine typically consists of devices where each action would trigger the next device, leading to a chain reaction and completion of a goal.
2. What are simple machines?
   1. **Review these slides on simple machines (typed below is what the slides contain)** [Simple Machines](https://docs.google.com/presentation/d/1WYaTaL3S2X2WQ6GF1muHttGDrNk5hbOgR1eeELoXO64/edit?usp=sharing)
   2. [Link: <https://docs.google.com/presentation/d/1WYaTaL3S2X2WQ6GF1muHttGDrNk5hbOgR1eeELoXO64/edit?usp=sharing> ]
      1. Simple Machines are machines with few or no moving parts that are used to make work easier
      2. Work is the force acting on an object in the direction of motion, a machine makes work easier to perform when it
         1. Transfers force from one place to another
         2. Changes direction of force
         3. Increase magnitude of the force
         4. Increase distance/speed of force
      3. Types of simple machines
         1. Wedge
            1. Pushes materials apart, cut things
         2. Wheel and axle
            1. Makes it easy to move things by rolling them
         3. Lever
            1. Makes lifting weight easier by using a fulcrum to redirect force over a longer distance
         4. Inclined plane
            1. Makes it easier to move objects upward
         5. Screw
            1. Turns rotation into lengthwise movement
            2. Takes many twists to go a short distance
            3. Holds things together
         6. Pulley
            1. Makes lifting things with a rope easier by redirecting the force
      4. What’s the use?
         1. Simple machines make it easier to do things
   3. Connection to Rude Goldberg
      1. A Rude Goldberg Machine is a complex machine a.k.a a combination of a lot of different simple machines

## Procedure



Week 1

1. Have students watch videos/lessons about simple machines and pulley and how it connects to what a Rube Goldberg Machine is
2. During this week students will be sketching out their machine designs and getting advice from teachers/other students what they can add on or improve on
   1. Designs should be approved by teacher and aim to have examples of 6 simple machines
   2. During this week, students will be listing out what materials (from the given list) that they will need to use and how many they are expected to use
      1. **Teacher:** prepare the materials for the students based on what they claim to need, explain to the students that if they have an item at home that they would like to use they may use that too

Week 2/3

1. Start building the machine, testing out what works and what doesn’t while writing down improvements and more ideas onto the student notebook
2. Students should be trying to make the most creative machine they can
3. Have students bring sketches or email images of their progress to share with the class
4. Encourage students to incorporate elements from the designs of others into theirs

Week 4

1. Show and tell to the class -- encourage them to bring a sketch and/or email photos/videos to present to the class
2. Reflection of project in the lab notebook
   1. What did you learn from this project?
   2. How might you use simple machines in day-to-day life?
   3. What worked with your project? What didn’t work?

## Key Concepts and Vocabulary

* **Simple Machine:** Machines with few or no moving parts that are used to make work easier
* **Complex Machine:** Combination of two or more simple machines
* **Rude Goldberg Machine:** Chain reaction-type machine or contraption intentionally designed to perform a simple task in an indirect and overly complicated way