

4th Grade Rube Goldberg's Simple Machines Challenge: Build Your Own Rube Goldberg Machine

Grade Level: 4th Grade

Duration: Two 60-minute periods

Lesson Overview

Students will explore the principles of simple machines by designing and building their own Rube Goldberg machines using levers, pulleys, ramps, and other materials. This hands-on activity encourages creativity, problem-solving, and collaboration.

Preparation Instructions

1. **Materials Preparation:** Gather all materials needed for the activity, including cardboard, marbles, string, tape, scissors, and various small objects (e.g., cups, blocks).
2. **Video Selection:** Choose and prepare the short videos of Rube Goldberg machines for the hook activity.
3. **Presentation Slides:** Ensure that the [presentation slides](#) on simple machines are ready and accessible to students.
4. **Group Organization:** Plan how to divide students into small groups effectively.

Materials Needed

- Cardboard
- Marbles or small balls
- String
- Tape
- Scissors
- Various other small objects (e.g., cups, blocks, etc.)

Learning Objective

By the end of the lesson, students will be able to:

- Identify and explain the function of at least four different simple machines in their Rube Goldberg machine.

- Demonstrate the ability to work collaboratively in groups to design and build a functional Rube Goldberg machine.

Day 1:

Engage (15 minutes)

Hook Activity: Show one or both of the short videos of a Rube Goldberg machine in action from these [presentation slides](#). Discuss with students what they observed and how the machine works.

Questions to Consider:

- What are the different parts of the machine?
- How do the parts work together to accomplish a task?
- What simple machines can you identify?

Explore (30 minutes)

Introduction to Simple Machines: Provide a brief overview of levers, pulleys, and ramps using these [presentation slides](#).

- **Levers:** Explain how levers make it easier to lift things.
- **Pulleys:** Discuss how pulleys can lift objects using ropes.
- **Ramps:** Show how ramps help move objects to a higher position with less effort.

Hands-On Activity:

1. Break students into small groups and show them the materials that will be provided for them to build their machines. Offer a variety of materials (e.g., cardboard, marbles, string, scissors, tape).
2. Have students work in small groups to design a simple Rube Goldberg machine incorporating at least one lever, pulley, ramp, and **two** challenges.
3. Have students draw their designs on a piece of paper. Tell students they will be building their design during their next STEM BrainBooster class.

Challenges: Examples:

- **Make the Marble Travel the Longest Distance:** Challenge students to extend the path of their marble by adding ramps, loops, or even a seesaw to keep it going for a longer time.
- **Incorporate a Ramp or Slide:** Have students design a ramp or slide that the marble must travel down, incorporating different angles or heights to affect the speed and movement of the marble.
- **Create a Domino Effect:** Ask students to add a simple domino setup that knocks over objects in their machine, making the process more dramatic and fun.
- **Use a Lever:** Encourage students to design a lever (e.g., using a ruler and a pencil) that triggers the next step in the chain reaction, like launching an object or knocking something over.

- **Add a Simple Pulley:** Students could incorporate a basic pulley system to lift or move an object in their machine, using string and a spool.
- **Balloon Pop:** Students could incorporate a balloon that gets popped at the end of the chain reaction, using the marble or another object to burst it.
- **Use a Swinging Object:** Have students create a swinging object, like a pendulum (a string with a small weight), that can trigger another part of the machine once it swings down.
- **Create a Simple Trapdoor:** Challenge students to design a trapdoor that opens when the marble hits it, causing an object to drop or move.
- **Magnet Interaction:** Introduce a magnet and metal object into the machine. Students could have the marble activate the magnet, causing it to pull or release a metal object.
- **Create a Simple Ramp with a Zigzag Path:** Students could make a ramp that zigzags back and forth, forcing the marble to travel a longer path and make its way through different angles before hitting the next step.

Explain (15 minutes)

Group Presentations: Each group presents their Rube Goldberg machine design to another group, explaining the purpose of each component and how it works.

Key Concepts Discussion: Have the groups discuss the different simple machines used in each design and how they contribute to the overall function of the Rube Goldberg machine.

Day 2: Build (40 minutes)

Building Phase: Allow students to construct their Rube Goldberg machines using the materials provided. Encourage them to test and modify their designs as needed.

Gallery Walk (15 minutes)

Present and Get Feedback:

Have students participate in a gallery walk where half the groups show their designs while the other half moves between groups. Then have the groups switch roles. Tell the students to offer a glow (something they liked) and a grow (something they wonder or a piece of feedback for improvement).

Quick Observable Assessment

During the gallery walk, observe each group's ability to:

- Clearly explain the function of the simple machines they used in their Rube Goldberg machine.
- Demonstrate teamwork and collaboration in their design and construction process.
- Incorporate feedback from peers to enhance their designs.

Aligned Standards

- **Utah SEEd Standard 4.2.2:** Plan and conduct an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.
- **Utah SEEd Standard 4.1.1:** Develop and use a model to describe how the motion of an object is affected by the forces acting on it.