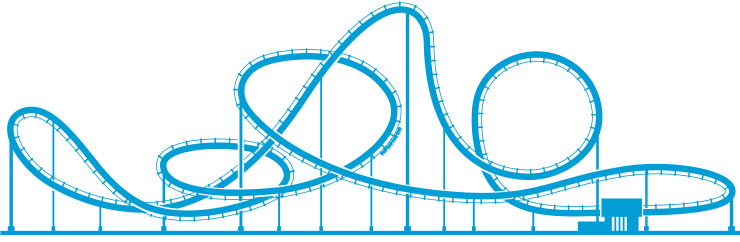


ACTIVITY 4: ENGINEERING A SLOW MARBLE RUN



In this engineering challenge, students will simulate the experience of a smooth mountain bike trail ride, by building a series of interconnected ramps using household materials to guide a marble from one spot in the classroom to a distant location. The goal is to create a track that allows the marble to travel at the slowest, smoothest speed

Materials:

- 1/2" diameter Reusable metal drinking straws (Straight)*
- 1/2" diameter reusable metal drinking straws (Bent)*
- 1/4" diameter steel ball bearings
- Clear plastic tape
- Wooden cubes of varying sizes (e.g. 1" or 2")
- Scissors
- Ruler
- Stopwatch or timer

**Alternatively, you can get straight and bent milkshake straws instead*

First, inform students that they will be designing and building a track to get a marble to move from one area of the classroom to another in the longest possible amount of time. Have them form groups of 3-4 and gather materials.

Next, specify the starting/ending locations for the track and give students time to plan their designs.

Then, give students a chance to explore the materials and begin building their tracks. Let them know they have a set period of time for testing and refining their designs. Encourage students to time how long it takes for the marble to travel from the start to the finish, and then refine their designs by making modifications that slow down the marble's speed while maintaining a smooth ride. Once the allowed time period is finished, they must stop building their marble runs.

Last, hold a competition where each group will run their marble down their track, and a designated timer will measure the "official" time it takes for the marble to reach the finish. The group with the slowest time wins the competition.

Following the competition, have a class discussion about the engineering process and the factors that affected the marble's speed and smoothness. Emphasize the importance of considering the different gradients at each point in the track they designed and how that related to the marble's acceleration and affected its motion. Ask students to share their thoughts on what worked well in their designs and what challenges they faced. Discuss the importance of friction, slope, and obstacles (such as if any groups made an upward-running part of their track) in slowing down the marble. Finish with discussing what challenges mountain bike trail engineers would face in doing designing a smooth trail ride for bikes.