Marble Run

Science
Film
Festival Knowledge Through Entertainment

Science Film Festival Film

▶ **The Marble Brothers' Great Adventure!**

Introduction

Everybody wants to get to their destination as fast as possible. Moving things efficiently from one point to another is a challenge that engineers have been working on for hundreds of years. Engineers use creativity to solve this and many other problems.

In this experiment we have set up a ramp. A ramp or inclined plane is an example of one of the six types of simple machines. A simple machine allows you to use less force to push or pull an object over a greater distance. When using simple machines, we can also look at the potential and kinetic energy of the marble. When the marble is at the top of the ramp it has high potential energy, also known as stored energy. As the marble travels down the ramp is builds kinetic energy, or energy in motion. The marble will have the greatest amount of kinetic energy when it reaches the bottom of the ramp, because it would continue to gain energy as it travels down the ramp. Objects that have different masses usually have different amounts of potential and kinetic energy and will also take different times to travel down the ramp.

Key Objectives

- To understand that potential energy is the energy that is stored in an object.
- To understand that kinetic energy is the energy of an object in motion. When the marble begins to fly down the marble run, that energy is kinetic energy.
- To understand that gravity is the force that pulls everything down toward the earth.
- To understand that that marble teetering at the top of the ramp has the potential energy of gravity - which is the force that will pull it down the ramp.

Materials

Per whole group:
- Stopwatch or timer application

Per team:
- 1 pair of scissors
- 5 plastic cups
- At least 1 marble
- 2 empty cereal boxes
- 10 paper towel tubes
- 1 roll of duct or masking tape
- Heavy items to place on top of eggs such as books, cans of food, bricks, etc
- Cardboard
- Water and container

Safety Instructions

Marbles are choking hazards for young children, so take precautions to keep marbles from getting into the mouths of little ones.

Intermediate

Resource Type
Project

Topics
Design   Engineering

Subjects
Physics

Keywords
Gravity   Friction   Inertia
Drag   Kinetic Energy

Time For Activity
30 – 45 minutes

Guiding Questions

1

What are some systems that are designed to move things along a specific course? (Aqueduct, sewer, roller coaster, subway, escalator, conveyor belt, power line, etc.)

2

If you make chutes that change direction, will your marble roll more slowly?

3

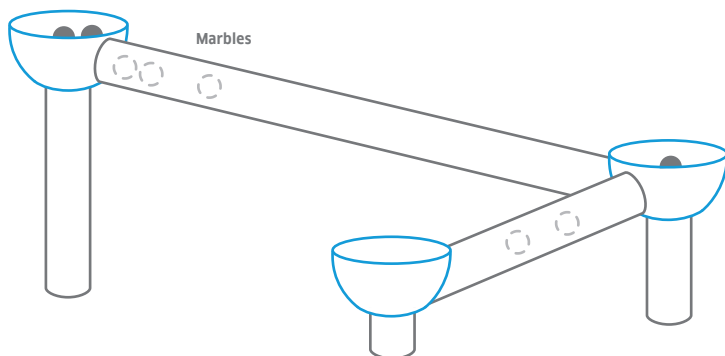What if you slanted a chute up and then the next chute down—what would your marble do?

4

How does the length of the chute speed up or slow a marble down?

Marble Run

Tasks/Steps

1 Choose an area with plenty of room to spread out and build. It should include some furniture (e.g., desks, tables, chairs) for participants to use as part of their marble run.

2 Introduce the design challenge. Teams of 3 or 4 participants design and build a marble run that keeps a marble rolling for the longest time.

3 Each team gets 10 paper tubes, 2 cereal boxes, 5 cups, 1 pair of scissors, 1 roll of tape, and at least 1 marble.

4 Give teams 5 minutes to plan their marble run. Some tips you can share:

a The goal is to keep the marble rolling as long as possible, not as far as possible.

b You can cut the tubes in half lengthwise to make chutes. You may or may not want to do this with all of your tubes.

c Use the environment to your advantage. You can build on walls, chairs, tables, and even the floor.

d What will cause the marble to speed up as it goes along? (Gravity)

e What will cause it to slow down? (Going uphill, friction as it rubs against other objects, drag as it goes through the air)

5 Give teams 20 minutes to build their marble run. Teams should test their creations as they go and refine them to keep the ball rolling as long as possible.

6 Give 5-minute, 1-minute, and 30-second warnings that time is almost up.

7 Test the marble runs. One person from each team will be the timer and another will release the marble. Remaining team members may monitor the marble as it proceeds along the track or may hold up parts of the marble run.

8 Keep track of the times and announce the team who kept the marble rolling the longest.

Marbles