LESSON 6: MARBLE MAZE

SUPPLIES

MAIN BIN

- Paper Plates (30)
- Push Pins (600)
- Masking Tape (2)

HANDOUT FOLDER

- Construction Paper (optional)
- Paper (30)

PENCIL BOX

- Marbles (20)
- Pencils
- Scissors
- Markers
- Clear Tape

OBJECTIVES

- [x] To follow the engineering process of creating a maze
- [x] To create a working marble run maze using simple materials

HOOK

2-3 min

Have you ever wondered what happens when you jump up in the air? You always come back down, that's gravity at work! As the saying goes, "What goes up must come down!"

INTRODUCTION

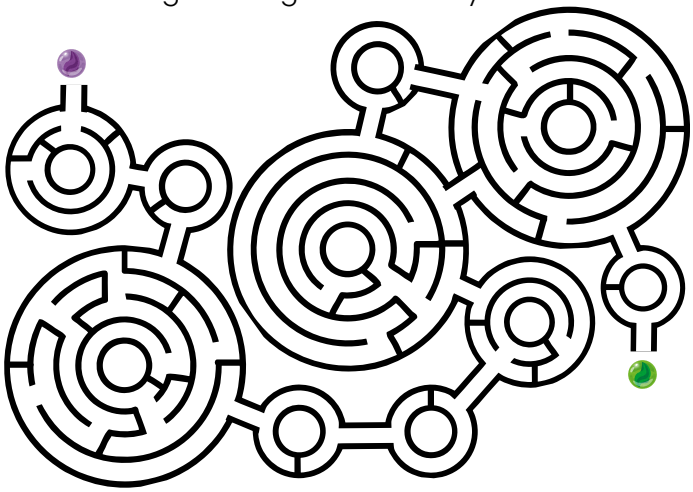
3-5 min

Today, we're going to explore gravity by creating our very own marble maze! Gravity is the force that pulls everything towards the ground. Engineers must work with and against this powerful force in real-life projects. Can you think of ways engineers might have to deal with gravity? Whether they're designing maze runs or launching rockets, engineers are always considering the effects of gravity.

We'll be looking at a few areas in which gravity plays a major role in engineering:

- Working with gravity: Engineers work <u>with</u> gravity when dealing with Structural Engineering, Transportation, and Mining
- Working against gravity: Engineers work <u>against</u> gravity when dealing with Aerospace Engineering and Space Exploration

Let's take these gravitational advantages and disadvantages into account as we begin to engineer our very own marble maze!



MARBLE MAZE

DESIGN & BUILD

25-30 min

Take a moment to provide students with a marble maze demonstration. Then, give students 20-25 minutes to create their own marble maze runs.

DIRECTIONS

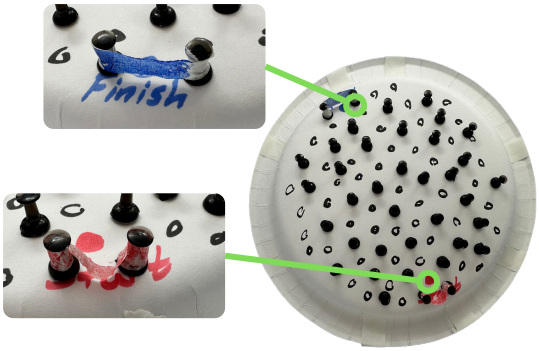
1. Pass out materials to each student. On the back side of a paper plate, instruct students to mark the "start" and "end" points for their maze.

2. Students will then mark the spots they want to place their thumbtacks. Students can use markers to decorate their paper plate at this time.

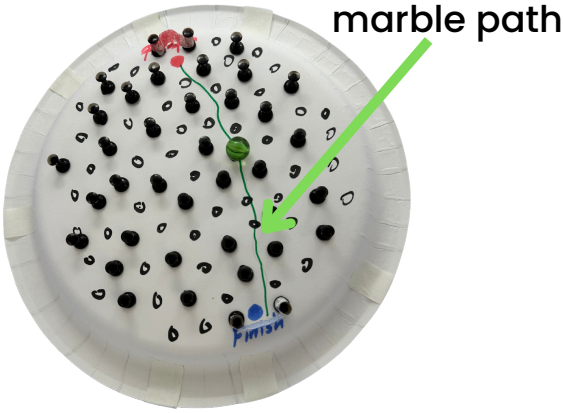
3. Next. students will tape a second paper plate to the first plate so that there is a hollow space between them (the back sides of the plate should be facing out).

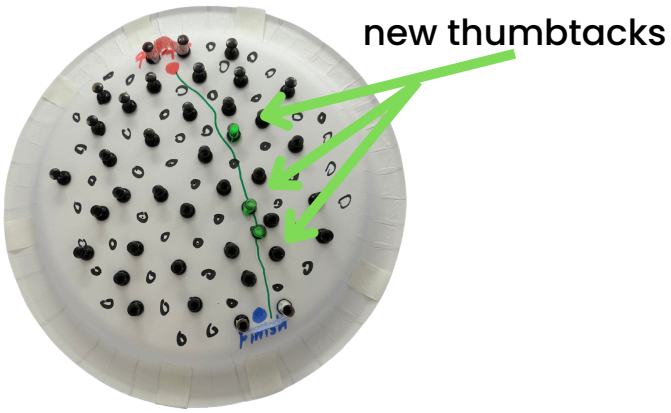
4. Instruct students to carefully place push pins at the "start" and "finish" marks. Then, use masking tape to create a "goal."

5. Instruct student to carefully stick thumbtacks into the plate. Once complete, allow students to test their maze as they attempt to move a marble from the "start" goal to the "end" goal.



6. To increase difficulty, allow students to trace the easiest path between the "start" and "finish" points, then add more thumbtacks along that path.





MARBLE MAZE

EVALUATE & REDESIGN

15-20 min

Allow students 10 minutes to try out each other's mazes.

Then, give them 5-10 minutes to make changes to their own designs or complete the extra challenges.

OBSERVE & EXPLAIN

5-7 min

Ask students to think about all the marble runs they tried. Then ask:

- How do the marble runs differ?
- How are they the same?
- What made a marble run effective?
- What was difficult about the design?
- What did you improve based on others' designs?

Discuss with students that narrow gaps were difficult for the marble to move through. These gaps could cause the user to tilt the plate too far and cause the marble to get stuck or fall off the plate entirely due to **gravity**.

EXTENSION

- Time your maze run and try to beat your best time
- Adjust the start or finish locations to increase difficulty
- Add or remove additional push pins
- Use tape to include dead ends or other obstacles.

Our marble mazes highlighted not only various engineering and design principals, but also gravity and incline as we worked to complete our maze by tilting the paper plate to increase or decrease marble speed and adjust marble direction. Adding additional elements such as dead ends or other obstacles also allowed us to experiment with both momentum and friction within our maze. Engineers consider and experiment with these factors all the time and today you did too!

Exit Ticket

Ask each student one of the following questions as they walk out the door.

- Q: What are some examples of ways engineers work with or against gravity?
  - A: Engineers work with gravity when working with Structural Engineering, Transportation and Mining. Engineers work against gravity when working with Aerospace Engineering and Space Exploration.
- Q: Can you define gravity?
  - A: Gravity is the powerful force that pulls everything towards the ground.