Ready • Set EXPLORE in the classroom

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Kindergarten Lesson Plan – Marble Maze Madness!

Suggested time: 45 minutes

Lesson Snapshot:

In this lesson, students will be challenged to design the fastest marble pathway incorporating at least one change in direction. Students will demonstrate proficiency by applying an understanding of the effects of incline and change of direction on the motion of an object to formulate a design solution that works as intended.

The disciplinary core ideas provide natural opportunities for discussion focused on pushes and pulls.

The crosscutting concept of cause and effect is woven into this lesson as students test their initial design and redesign their marble maze.

Background Information:

Motion occurs when an object moves from one location to another. Force is the factor responsible for initiating or halting the movement of an object. Force is a scientific term for either a push or a pull that is applied to an object. Pushing or pulling on an object can change the speed or direction of its motion and can start or stop it.

The force is generated when two objects interact, and it ceases when the interaction concludes. There are two types of forces: contact forces and field forces. Contact forces occur when objects make physical contact. Examples of contact force include a person kicking a ball or pushing a wagon. In contrast, field forces occur when two objects interact without direct contact. Gravity is an example of a field force.

Fun Fact: Did you know gravity pulls all objects down at the same speed, regardless of the object's weight?

Science, Technology & Engineering, and Environment Literacy & Sustainability (STEELS) Standard(s):

3.2.K.A: Analyze data to determine if a design solution works as intended to change the speed or direction of an object with a push or a pull.

3.5.K-2.X: Develop a plan in order to complete a task.

3.5.K-2.DD: Collaborate effectively as a member of a team.

Connections to Other Standard(s):

CC.1.5.K-2.A: Participate in collaborative conversations with peers and adults in small and larger groups.

CC.2.1.K.A.3: Apply the concept of magnitude to compare numbers and quantities.

CC.5.4.K.B: Identify how students can work together.

Objective(s):

Students will design a ramp system to demonstrate marble speed using different variables such as change of direction and incline.

Students will apply an understanding of the effects of incline and change of direction on the motion of an object to analyze a design solution that works as intended.

Materials:

- **Oscar and the Cricket: A Book About Moving and Rolling** by Geoff Waring
- Magna-tiles
- Magnatiles Marble Run Maze
- Stop watches (1 per group)
- Marbles (1 per student)

- Small transparent container with lid (1 per student)
- Student Checklist of Design "Requirements" (at the end of this file)
- Whole class data recording sheet (at the end of this file)

Advanced Preparation:

Prepare marbles in transparent containers for whole class discussion.

Suggested Implementation:

Part 1: Shared Read Aloud

Read *Oscar and the Cricket: A Book About Moving and Rolling* by Geoff Waring

Class Discussion Questions:

"What are ways we can make a marble move?" (push, incline)

"How can we make this marble move?" (Show students a marble in a transparent container)

Discuss student responses, guiding students to understand that creating an incline makes the marble move.

Part 2: Investigation(s)

Distribute transparent containers with marbles.

Allow students the opportunity to explore the marble movement inside of the container.

Discuss findings.

Discuss how speed can be adjusted with changes in incline.

Part 3: Design

Students will work collaboratively in groups to design a marble run which includes at least one turn.

Each group will be challenged to design the quickest marble run.

Test 1:

With teacher support, each group will be given an opportunity to test their marble run, record time and compare results.

Class Discussion:

Whole-class discussion focused on which group design solution worked as intended to increase the speed of the marble.

"How can we improve our design to make the marble go faster?"

"Does the placement of the turn impact the design?"

Students will be given an opportunity to redesign their marble run.

Test 2:

With teacher support, each group will be given an opportunity to test their marble run, record time and compare results.

Part 4: Summation

Review/discuss key components needed to design a ramp system to demonstrate marble speed (incline).

Review/discuss the impact of the curve/turn on the overall design.

Extension Activities:

- Challenge students to redesign a ramp system by adding turns and inclines to test the marble speed and compare results.
- Design a ramp system using recycling materials such as paper rolls or art tubes, cardboard, etc.
- Take a virtual trip on a rollercoaster.
- Explore engineering careers that specialize in force and motion such as engineers who design roller coasters.

PBS Resources and Links:

Roller Coaster Design | PBS LearningMedia (video short: :53 seconds)

Engineering Career Videos – Pennsylvania PBS (video short: "Justin" roller coaster designer)

Curious George: Ramp-n-Roll | PBS LearningMedia (video short: :51 seconds)

Pushes and Pulls | Hero Elementary™ | PBS LearningMedia (video episode: 11:02 minutes)

Connections to Other Standard(s):

3.5.K-2.M: Demonstrate essential skills of the engineering design process.

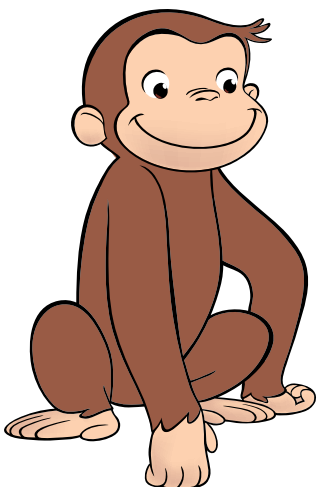3.5.K-2.O: Illustrate that there are different solutions to a design and that none are perfect.

3.5.K-2.S: Apply design concepts, principles, and processes through play and exploration.

3.5.K-2.CC: Discuss the roles of scientists, engineers, technologists, and others who work with technology.

Resources/Acknowledgments:
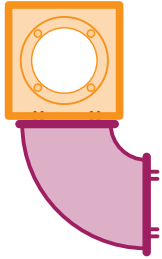
STEELS Hub - SAS (pdesas.org)

Britannica Kids

Marble Maze Design Checklist

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Group _____
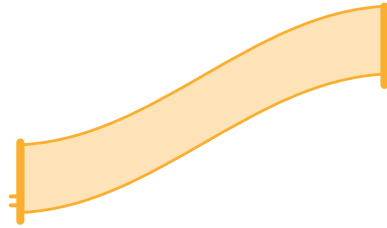
Design 1:

Does your marble maze have…

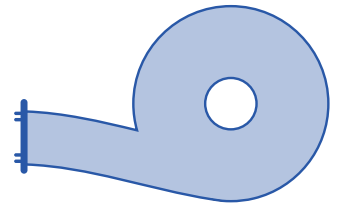☐ a start?   ☐ 1 turn?   ☐ 1 incline?   ☐ an end?

Test 1:

Test your marble run.

Time how fast your marble runs from start to end.

Record time _____

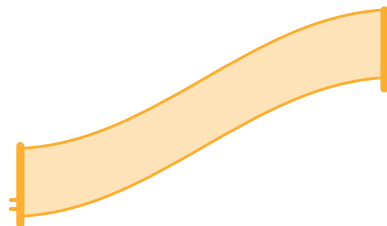**Design 2:**

Does your marble maze have…
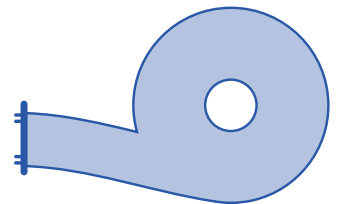
☐ a start?   ☐ 1 turn?   ☐ 1 incline?   ☐ an end?

Test 2:

Test your marble run.

Time how fast your marble runs from start to end.

Record time _____

Marble Maze Class Data

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Group	Test 1 Results	Design Discussion	Test 2 Results	Design Discussion
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				