Marble Run

SOCIAL-EMOTIONAL CONNECTION: Interrelatedness GRADES: 5th TIME: 90 Minutes INSTRUCTOR

EXPERIENCE: Intermediate

OBJECTIVES: To design and construct a marble run using limited materials, with an emphasis on problem solving, engineering, and design principles.

ESSENTIAL QUESTION: How can a marble run be used as a metaphor for understanding complex systems and processes in the real world?

MATERIALS:
- Book- What if
- Design Challenge Sheet
- Computer
- Projector
- Marbles
- Cardboard tubes (toilet paper rolls, paper towel rolls)
- Craft sticks
- Tape (duct tape, masking tape)
- Scissors
- Rulers
- String
- Cardboard sheets
- Plastic cups

STANDARDS: VA STEM
    5.1a-f;5.3c and e

SCIENTIFIC AND ENGINEERING PRACTICES:

🍃 *plan and conduct an investigation related to net force and the movement of an object*

🍃 *plan and conduct an investigation to determine the effect of friction on moving objects*

Lesson delivery note: This lesson is designed to take approximately 90 minutes. Adapt the lesson to fit the amount of available time.

INSTRUCTIONS

1. Ask (5 minutes)

- What is a marble run and how does it work?

Marble Run

• What principles of physics and engineering are at play in a marble run?
• How can we design a marble run that is both challenging and functional?

2. Research (15 minutes)

• Read the book titled, "What If"
 • Hold up the book and ask students to join you for a whole group read
                        aloud.
 • Today, we are going to build a marble run. Can you find some examples online?

 • How does gravity, momentum, and friction affect a marble's movement?

3. Connect to Careers (10 minutes)

● The physics of roller coasters: video

4. Tinker to Discover (10 minutes)

1. Allow students to investigate the materials, seeing how marbles interact with them.

2. Pose challenges like designing the track to impact the speed of the marble to move faster/slower or change direction.

5. Build a Prototype (15 minutes)

1. Using the materials provided, each group should design and build their marble run.

2. Emphasize the importance of planning and sketching a design before starting to build.

6. Test & Improve (25 minutes)

• Test the marble runs to see if they function as desired.
• Observe any problem areas where the marble stops, jumps off track, or moves too quickly/slowly.
• Make adjustments and improvements based on observations and feedback from peers.

7. Discuss and Reflect (10 minutes)

• What challenges did you face when building your marble run?
• How did you overcome these challenges?
• What would you do differently next time?
• What principles of physics did you see in action?

EXTENSION ACTIVITIES

STEM TOOLKIT ACTIVITY

Marble Run

- Marble Run Competition: Create criteria for scoring (longest run time, most creative use of materials)
- Storytelling: Have students tell a story or narrative using their marble run as a backdrop.