Rolling Ramps: Teamwork and Design in Marble Run Engineering

Grade Levels: 2nd to 5th Grade

Duration: 60 minutes

Standards:

- Next Generation Science Standards (NGSS):
    - 3-5-ETS1-1: Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
    - 3-5-ETS1-2: Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Common Core State Standards (CCSS):
    - CCSS.ELA-LITERACY.SL.2.1: Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups.
    - CCSS.ELA-LITERACY.SL.3.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.
    - CCSS.ELA-LITERACY.SL.4.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.
    - CCSS.ELA-LITERACY.SL.5.1: Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly.

Objectives:

- Students will collaborate in teams to design and construct a marble run using printable cardstock or alternative materials.
- Students will apply the engineering design process, including brainstorming, planning, building, testing, and refining their marble runs.
- Students will demonstrate effective teamwork, communication, and problem-solving skills throughout the activity.
- Students will reflect on their marble runs, identifying successes, challenges, and opportunities for improvement.

Materials:

- Printable cardstock or alternative materials (e.g., paper towel rolls, toilet paper rolls, cardboard)
- Scissors
- Tape
- Marbles

Procedure:

Introduction (5 minutes):

- Introduce the lesson by discussing the concept of marble runs and their importance in engineering and physics.
- Emphasize the role of teamwork, creativity, and the engineering design process in completing the marble run challenge.

Group Formation and Brainstorming (10 minutes):

- Divide students into small teams and distribute materials.
- Encourage teams to brainstorm and sketch their marble run designs, considering factors such as slope, speed, and obstacle placement.
- Emphasize the importance of collaboration and effective communication within the teams.

Construction Phase (20 minutes):

- Allow teams time to construct their marble runs according to their designs, using the provided materials.
- Circulate among the teams to provide guidance and support as needed, emphasizing the engineering design process.

Testing and Adjustment (10 minutes):

- After construction, provide time for teams to test their marble runs using marbles.
- Encourage teams to observe the behavior of the marbles, noting any areas of improvement or adjustment needed.
- Allow teams to make necessary adjustments to enhance the performance of their marble runs.

Reflection and Discussion (10 minutes):

- Gather students for a group discussion on their marble run experiences.
- Encourage teams to share what worked well in their designs and any challenges they encountered.
- Facilitate a reflection on the teamwork process, discussing strategies for effective collaboration and problem-solving.

Conclusion (5 minutes):

- Summarize key points from the discussion, highlighting the importance of teamwork, creativity, and the engineering design process.
- Congratulate students on their efforts and accomplishments.
- Encourage students to continue exploring STEM concepts and applying their problem-solving skills in future projects.

Assessment:

- Observation of students' collaboration, communication, and problem-solving skills throughout the activity.
- Evaluation of students' marble runs based on criteria such as stability, speed, and creativity.
- Participation in group discussions and reflection on teamwork and project outcomes.

Extension:

- Encourage students to explore additional challenges or modifications to their marble runs, such as incorporating loops, ramps, or other obstacles.
- Provide opportunities for students to showcase their marble runs to the class or to create a collaborative marble run exhibit.