Hands on Engineering Activity 5

Topic: Motion and Forces in design

Learning Objective: Students will be asked to design a roller coaster as a group. The rollercoaster must contain one hill and end at the paper cup terminal. All true roller coasters are completely driven by the force of gravity. Friction will slow down cars in rollercoaster. Takes away energy. Total energy of the car=Potential energy + Kinetic energy. Potential: energy stored by an object, the velocity is zero or almost zero. Kinetic: potential energy is transformed to this once the car gains velocity (starts movement).

Alignment with NGSS Grades 3-5

Science and Engineering Practices

Asking Questions and Designing Problems

- Ask questions that can be investigated and predict reasonable outcomes based on patterns such as cause-and-effect relationships.
- Use prior knowledge to solve problems that can be solved.

Crosscutting Concepts and Connections to Engineering, Technology, and Applications of Science

Energy and Matter: Flows, Cycles, and Conservation

- Energy can be transferred in various ways and between objects.

Performance Expectations and Disciplinary Core Ideas for Grade 3

- 3-PS2-1 Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on motion of an object.

Materials:

- Marbles
- Paper cups
- Foam Pipe Insulation, cut in half
- Masking tape
- Toothpicks
- Support materials-Cardboard tubes, dowels, large tongue depressors

Detailed Description

- Activity
    - Students will first be asked to describe their experiences with rollercoasters
        - How do they think hills and loops in those roller coasters affect its movement?

        - What's the same between all roller coasters at the beginning? (A large drop or anything that makes it quickly pick up speed. A chain pulls up the car to the hill.)
    - Instructor will demonstrate that first hill must be tallest for the car to reach the end of its journey
    - Instructor will give students time to create their own rollercoaster and help with modifications when necessary

How will you conclude the lesson to enforce the learning objective:
Students will breakdown their rollercoaster after a sketch of it has been drawn on the board. Based on trial and error runs, students will be asked why they believe certain designs did/ did not work. Students will be asked why they believe it's important to learn about roller coasters.

What science process skills will this lesson exercise?
Inferring, Predicting, Communicating, Formulating hypotheses, Experimenting, Acquiring data, Understanding cause and effect relationships

Safety precautions
Project includes work with small objects (marbles)