

23. ROLLER COASTER COMPETITION



GRADES 7, 11 and 12

ASSESSMENT CATEGORIES

- Knowledge and Understanding
- Thinking and Investigation
- Communication
- Team-Building Skills

LESSON DESCRIPTION

Students design and build a roller coaster using pipe insulation and straws. A marble will serve as the car.

PREPARATION TIME 2-3 hours

ACTIVITY DURATION 75 minutes

Students are expected to research the subject outside of class

STRAND

Understanding Structures and Mechanisms

Grade Seven

This task addresses the following grade 7 expectations:

- design and construct a variety of structures, and investigate the relationship between the design and function of these structures and the forces that act of them
- demonstrate an understanding of the relationship between structural forms and the forces that act on and within them.
- design, construct, and use physical models to investigate the effects of various forces on structures
- investigate the factors that determine the ability of a structure to support a load

- use technological problem-solving skills to determine the most efficient way for a structure to support a given load
- classify structures as solid structures, frame structures, or shell structures
- describe ways in which the centre of gravity of a structure affects the structure's stability
- identify the magnitude, direction, point of application, and plane of application of the forces applied to a structure
- distinguish between external forces and internal forces acting on a structure
- describe the role of symmetry in structures
- identify and describe factors that can cause a structure to fail
- identify the factors that determine the suitability of materials for use in manufacturing a product

See supplementary document *Ontario Curriculum Alignment for Engineer-in-Residence Secondary Classroom Activities: Science and Technological Education* for relevant overall and specific expectations.

STRAND

Science

Courses

Physics,
Grade 11 University

- C. Forces

Physics,
Grade 12 University

- B. Dynamics

Physics,
Grade 12 Open

- B. Motion and its Applications

STUDENT MATERIALS

- 2 lengths pipe insulation (the track)
- paper clips (limited quantity)
- twist ties (limited quantity)
- duct tape (limited quantity)
- straws (limited quantity)
- a marble
- chair

HOOK

Roller coaster joke:

"It's not the most exciting theme park I've ever been to." I told my friend, as we looked at the painting of us together on the rollercoaster.

Share some of these ridiculous photos that people have staged on roller coasters. followed by photos of different types of roller coasters: <http://www.stuffyoushouldknow.com/blog/gallery/rollercoaster-photos/>

DEVELOPMENT

Discuss physics and engineering principles relevant to the grade level, including *Newton's Laws of Motion* and the following vocabulary:

- Gravity
- Acceleration
- Deceleration
- Compression
- Tension
- Frictional force
- Safety factor
- Side sway

Ask the class what structural elements are important to consider when designing a roller coaster. Make a list.

Ask the class to make a list of the safety considerations and features would that need to be considered when designing a roller coaster (minimum height, weight, age, seatbelts, electrical safety, rail guards, environmental concerns, etc.)

APPLICATION

Explain the task and divide students into teams of 3.

Using only the materials provided students are asked to build a roller coaster with at least two hills and one curve in the track. They are given 20 minutes to design the roller coaster and present the design to the EIR, and 20 minutes to construct it.

The pipe insulation provided cannot be cut. The initial launch platform will be no higher than the backrest of a student chair. A marble will serve as roller-coaster car. The goal is to have the marble successfully complete the course. To successfully complete the course, the marble must stay on the track and land on a target located at the track base.

One student from each group will demonstrate their roller coaster to the class.

CLOSURE

Ask students what they learned from the activity, what they liked about it, and what they would do differently if they did it again.