# Marble Roller Coaster Lesson Plan: 6th & 7th Grade

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**Overview:** This lesson is designed to teach students about kinetic and potential energy. Students will explore the energy by building a marble roller coaster.

**Objective/Purpose:**  This lesson is for 6th/7th grade science classes to learn about kinetic and potential energy.

**Materials:**

* Pipe insulation
* Masking tape
* Marbles
* Timers
* Tape measures
* Worksheets

**Discussion:** Introduce the vocabulary with the class, use this to gauge their knowledge on the subject for later. Explain to the students that curves and loops cause the energy of the marble to change.

Vocabulary:

**Force** – A push or a pull that acts on an object

**Energy** – The ability to do work

**Potential Energy** – The position of an object above the Earth’s surface.

**Kinetic Energy** – The energy of motion

**Centrifugal Force** – The effect that tends to move an object away from the center of a circle it is rotating about

**Friction** – The resistance force that one surface or object encounters when moving over another.

**Activity:** In groups, students will build roller coasters out of pipe insulation and masking tape. Break students up into groups of 3 or 4 students. Students will have few minutes to play with the materials. Then explain the rules of the roller coaster and what the students need to do. Show students how to connect sections of insulation with masking tape. One piece of tape on top, and one on bottom. Show students how to connect sections to the ground. One piece of tape on each side of the pipe insulation to anchor it to the ground.

Hand out the worksheets and explain:

a. Build a roller coaster with one loop and one 360 degree curve as shown in the plans.

b. The marble must not fall off until it gets to the end of the track.

c. They may use only the materials provided.

d. They may test their design as they go.

Explain that the students will need to not only build the roller coaster they will also need to test the roller coaster and record the speed of the roller coaster.

Students will have 25 minutes to build the roller coaster and complete the worksheet.

**Discussion/Closure:**  After students have collected the data, come back together as a whole class and discuss the different results of the runs. Discuss the answers that they wrote on the worksheets and go into more explanation if needed.

**Assessment:** Students will be assessed on their work in the group and their completed worksheet.

**Curriculum:**

Common Core Standards:

- 7.1: Forces interact with matter Forces are push or pull interactions between two objects. Changes in motion, balance and stability, and transfers of energy are all facilitated by forces on matter. Forces, including electric, magnetic, and gravitational forces, can act on objects that are not in contact with each other. Scientists use data from many sources to examine the cause and effect relationships determined by different forces.

- 7.1.3: Construct a model using observational evidence to describe the nature of fields that exist between objects that exert forces on each other even though the objects are not in contact. Emphasize the cause and effect relationship between properties of objects (such as magnets or electrically-charged objects) and the forces they exert.

Introduce the vocabulary with the class, (you will probably want to write the terms on the board) use this to gauge their knowledge on the subject for later discussion.

**Lesson Script**

Divide the students into groups and pass out the worksheets.

Introduce Materials to Students - Tell them that they will be building roller coasters.

* Have one set of materials for each group.
* Allow groups a few minutes to mess around with the materials.
* Show students how to connect sections of “track” with masking tape. One piece of tape on top, and one on bottom.
* Show students how to connect sections to the ground. One piece of tape on each side of the pipe insulation to anchor it to the ground.
* After they have had a few minutes, have students place the materials somewhere will they will not be tempted to play with them for the next section of the activity.

Introduce the parameters of the design, show & discuss with them the plans and specifications.

* Build a roller coaster with one vertical loop and one horizontal loop per plans.
* Your marble must not fall off until it gets to the end of the track.
* You may only use the materials provided.
* You may test your design as you go.
* Explain that they will need to not only build the roller coaster they will also need to test the roller coaster and record the speed of the marble on the roller coaster.
* Explain that they will have 25 minutes to build the roller coaster and complete the worksheet.

Before dismissing them to work, Ask the class: “What they think this has to do with Home Building?”

Briefly discuss the use of plans and specs to build a home and the plans and specs they will use to build the roller coaster (this discussion should be very brief, you will discuss in greater depth at the end).

Activity

* Give students about 25 minutes to build and test their roller coasters, and record their data.
  + Be sure the students have the plans and specs with the worksheet.
* Data Collection and Calculations
  + Have students do time trials and record results
* Interpret Data
  + Discuss the students answers to the questions on their worksheet

Conclusion

Ask the students: “What their times were? “

Discuss why some groups had different times

* Twisted track could slow the marble down
* Not building to plans/specs (having a different slope from the wall could affect the marble speed)
* Inadequate support (is the track moving as the marble goes down)

Ask the students the following questions and discuss their answers. Use this time to make connection with home building (talk about challenging or unique projects you’ve had):

* “What was the most challenging thing about building the roller coaster?”
  + “What made it challenging?
* “Now that you have built something based on plans and specs, what challenges do you think a home builder has building homes?”