



Potential and Kinetic Energy Lesson 3: *The Engineer* Student Handout

Your Challenge

Design a roller coaster track system that maximizes potential and kinetic energy and has the following three key features:

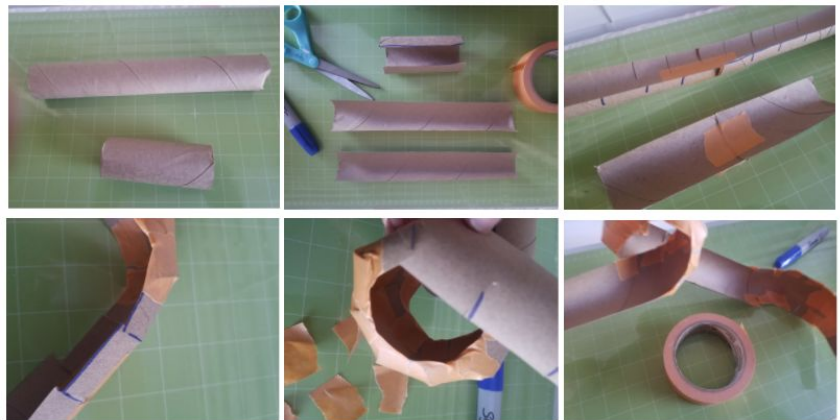
1. at least one loop, and
2. one banked curve, and
3. successfully delivers a marble into a cup at the end of the run.

If doing this in-class, your teacher will provide you with materials.

If doing this remotely, you will need at least **one marble** and **a cup** for catching the marble once it's traveled down the roller coaster. You can use **paper tubes** from paper towels or toilet paper to construct the roller coaster itself. Use **scissors** to cut the paper towel role lengthwise. Use **tape** (like masking tape) to attach pieces of tube together and to attach your roller coaster to a flat sturdy surface (like a wall or large piece of cardboard) before putting the marble down the run. See images below as an example:

Materials for at-home use

- 1 marble
- 1 cup
- Paper tubes
- Scissors
- Tape (masking tape is great but other tapes will do)





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Planning Organizer

**Draw your own idea for the roller coaster design in the space below.
Be sure to include the three key features.**

**Exchange ideas with your team, and together decide which design ideas will
be executed in your final design. Describe the ideas that your team will use in
the final design.**



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How will the following concepts be displayed in your project?	
Potential Energy (hint: relate to distance and position)	
Kinetic Energy (hint: relate to mass and speed)	

**Build your roller coaster, testing and revising the design as needed.
Demonstrate a successful run.**

Design Reflection
Describe the strategy you used to make a successful roller coaster. In your reflection, explain how you maximized <u>potential energy</u> and <u>kinetic energy</u> .



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Assessment: Final Roller Coaster Presentation

You have demonstrated that you can use your knowledge about energy to construct a roller coaster model that can deliver a marble to a cup after going through a loop and a banked curve. Now, it is time for your team to prepare a presentation about your design.

Use the Checklist and Cognitive Skills Rubric to ensure you have addressed all aspects of *The Engineer* with quality work.

Roller Coaster *The Engineer* Checklist

Your Challenge: Design a roller coaster track system that maximizes potential and kinetic energy to successfully deliver a marble into a cup at the end of the run.

Project Completeness:

- Roller coaster model complete
 - At least one loop
 - Banked curve
 - Lands a marble in a cup
- Sketch of coaster complete. Has labels for:
 - Greatest potential energy
 - Greatest kinetic energy
- All labels have a short caption explaining what the label is showing
- Sketch has a heading and (if doing this in class) all team members' names

DCI Standards Checklist:

- Roller Coaster Design:
 - Functions to deliver marble into a cup at the end of the run
 - Concepts of potential and kinetic energy are effectively applied in order to create an effective design

Cognitive Skills Assessed

	Emerging (1)	Developing (2)	Proficient (3)	Advanced (4)
Designing Solutions	Applies no scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies minimal scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies adequate scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.	Applies complete scientific principles and/or data to design, construct, and/or test a design of an object, tool, process, or system.