

Name:

Date:

Class:

PhET Roller Coaster Simulation Worksheet

Objective: To recreate a roller coaster in the skate park simulator and use data to explain how the energy changes over time.

Phase 1: Explore the Phenomenon

ASK & RESEARCH

What do you already know? What are we trying to find out?

Think back to the paper roller coaster your team built earlier in this unit.

Where on your track was your marble moving the *fastest*? Where was it moving the *slowest*?

Fastest point:

Slowest point:

Here is the mystery: Your marble always slowed down and eventually stopped. Where do you think its energy went? Was it destroyed?

Today you get “X-ray vision.” Go to the **PhET Energy Skate Park** simulation and let’s find out:
<https://phet.colorado.edu/en/simulations/energy-skate-park>

- Click the **Playground** screen.
- Drag pieces of track to build a coaster (a starting hill, a drop, and a loop or hill).
- Click the **energy bar-graph** icon so you can see the **Potential, Kinetic, Thermal, and Total** energy bars.

Phase 2: The Engineering Challenge

★ **Your Challenge:** Recreate your team’s roller coaster in the simulation. Then change one variable at a time to collect data that answers the mystery: *Where does the energy go?*

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PLAN

Design your tests before you start. Change one variable at a time.

You will change three variables: the starting height, the rider's mass, and the friction.
Which one will you test first, and what do you predict will happen to the energy?

**CREATE &
TEST**

Recreate your coaster, then run your tests and record every result.

Take a screenshot of your coaster with the energy bar graph showing and paste it in the box below.

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Run a trial for each change. For every trial, record what happened to the energy bars and where the rider was fastest or where it stalled.

Trial	Which variable did you change, and to what? (height / mass / friction)	What happened to the energy bars? (Potential, Kinetic, Thermal, Total)	Where was the rider fastest? Did it complete the track or stall?
1			
2			
3			
4			
5			
6			

IMPROVE

Use what you learned to adjust your coaster.

Adjust your track or your variables so the rider completes the whole track. What did you change, and what happened to the total energy when you added or removed friction?

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Phase 3: Analyze & Explain

Complete this part on your own, using the data you and your partner collected.

Look for the patterns in your data. Complete each sentence below using one of the variables you changed (height, mass, or friction). (*Example: As the height increases, the potential energy increases.*)

As the _____ increases, the _____ energy _____.

As the _____ increases, the _____ energy _____.

As the _____ increases, the _____ energy _____.

Now fill in each blank using evidence from your trials:

The **kinetic energy increases** when

_____.

The **potential energy decreases** when

_____.

The **thermal energy increases** when

_____.

The **total amount of energy** stays the

_____.

Answer our mystery: Where does the energy go when the roller coaster slows down and stops? Use your trial data as evidence and explain how you know the **total energy** is *conserved*. Use the words **potential energy**, **kinetic energy**, **thermal energy**, **friction**, and **total energy** in your answer.