LAB GUIDE

Physics of Roller Coasters

Grade Levels: 2-8
Duration: 90 min

Design a robust learning experience by selecting resources from this guide that fit the needs of your students. Reinforce learning before, after, and even during your visit by diving deeper into some of the science and engineering concepts.

When to implement

The following icons indicate when resources should be implemented for the greatest benefit to your students' experience in the lab.

Grade Levels: 2-8

Duration: 90 min

Concepts/Skills

Gravity, Potential Energy, Kinetic Energy, Engineering Design

Objectives

Students will:

- Demonstrate that gravity is a naturally occurring force that pulls objects toward the center of the Earth.
- Describe and demonstrate the difference between potential and kinetic energy.
- Work as a team to complete a given design challenge with constraints.

Vocabulary

BEFORE DURING AFTER

These are words and concepts that we will discuss in the lab. Your students' experience will be enhanced if they are familiar with these terms prior to your visit. If you need inspiration for vocabulary activities, please see our Vocabulary Choice Board activity.

Term	Definition
Energy	The ability to do work.
Force	An influence (push or pull) on a body or system, causing a change in movement or shape.
Gravity	A force that pulls objects toward the center of the Earth.
Kinetic Energy (KE)	The energy of motion. An object in any form of motion has kinetic energy (e.g., running, walking, dancing, flying, etc.).
Mechanical Energy	Energy possessed by an object due to its motion or its stored energy of position. Mechanical energy can be either kinetic (energy of motion) or potential (stored energy of position).
Potential Energy (PE)	The energy of position; energy that is stored and held in readiness — waiting to move (e.g., a ball held in the air, sitting still, waiting motionless).

Related Texts

BEFORE DURING AFTER

The following title may provide students with a greater contextual understanding of the field of chemical preservation and give additional opportunities to incorporate science and engineering into Language Arts lessons. We are not endorsing the following author but feel that the information presented in these texts may benefit your students and enhance their learning experience.

Age Range	Title and author	Text Type	Description
Grade 2	"The Thrills and Chills of Amusement Parks (Science and Fun)" by Jordan D. Brown	Reference	A nonfiction all about the science behind the fun of amusement parks. From rollercoasters to bumper cars, young scientists will flip when they learn about the science behind amusement parks in the fun, fact-filled read!
Grades 2-4	"Roller Coaster" by Marla Frazee	Narrative	Twelve people set aside their fears and ride a roller coaster, including one who has never done so before.
Grades 2-5 *(Raintree Fusion Edition)*	"Roller Coasters" by Robert Coker	Reference	Containing more than 150 images of the world's most terrifying rides, this book puts readers in the front seats of some of the largest coasters ever built. Spanning the whole history of roller coasters, from the 15th century to 2002, the book offers an in-depth look at the evolving technology of coaster design and construction.

Grades 3-7	"Calling All Innovators: Roller Coasters" by Kevin Cunningham	Reference	A fascinating look at how people in science, technology, engineering, and math (STEM) careers are helping to build our future.
Grades 6-12	"Roller Coasters" by Robert Coker	Reference	Containing more than 150 images of the world's most terrifying rides, this book puts readers in the front seats of some of the largest coasters ever built. Spanning the whole history of roller coasters, from the 15th century to 2002, the book offers an in-depth look at the evolving technology of coaster design and construction.

Exhibit Connections

BEFORE DURING AFTER

Make connections between learning from the lab and the exhibits and programs found in The Tech Interactive's galleries.

Science on a Roll

(found outside The Tech Interactive at the Park Ave. entrance)
Witness an elaborate demonstration of the transfer of potential and kinetic energy.

The Innovator

(Upper Level)
Design a heart-pounding roller coaster by customizing hills, dips, and thrills. Try out the many possible combinations of customizations before settling on a final design to experience at our coaster simulation station.

This exhibit makes a great accompaniment to this lab! Try visiting either before or after the lab!

Lab-Related Activities

The following activities can be implemented either before or after the lab and are meant to bridge the learning from the lab to the classroom.

Activity	Description	Time
Circle of Pong	Students use their knowledge of energy and forces to place a ball in the center of a 6-foot diameter circle. As students iterate through this design challenge, they gain first hand experience in the Innovation Design Process.	65 minutes
Energy Red Light Green Light	In this adaptation of the classic "red light, green light" game, students will physically practice the transfer of kinetic and potential energy.	20 minutes
Exploring Chain Reactions	Students will explore stored energy and energy transfer as they build a series of chain reactions.	65 minutes

Looking for other hands-on activities and resources to use in your classroom? Check out our **education resources** page!

Writing Prompts

The following writing prompts and questions are just a few examples of journal topics you can use to incorporate writing into your students' lab experience. These prompts can be used in conjunction with any classroom writing journal.

Pre-visit prompts

- We will be attending Physics of Roller Coasters at The Tech Interactive; what are you looking most forward to in this lab? Why?
- A new student at your school has never seen or heard of a roller coaster before. Explain to your classmate what a roller coaster is and what it is like to ride one.
- My favorite roller coaster is _____. It is my favorite because...

Post-visit prompts

- The principal is very excited to hear about your lab experience! Explain what you did and learned about in the lab since they were unable to attend the lab.
- You and your team created an amazing roller coaster in the lab. If your roller coaster was turned into a real roller coaster, would you ride it? Why or why not?
- The marble you used to test out your roller coaster must have had a wild ride! Write a story describing your roller coaster ride from the marble's point of view.

Next Generation Science Standards

Physics of Roller Coasters supports the following NGSS:

Grades	Engineering Design	Disciplinary Core Ideas	Crosscutting Concepts	Science and Engineering Practices
Grade 2	K-2-ETS1-1 K-2-ETS1-2 K-2-ETS1-3	ETS1.A ETS1.B ETS1.C	Cause and Effect Structure and Function	1, 2, 4
Grade 3	3-PS2-2 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	PS2.A PS2.B PS3.A ETS1.A ETS1.B ETS1.C	Patterns Cause and Effect Influence of Engineering, Technology, and Science on Society and the Natural World	1, 3, 6
Grade 4	4-PS3-1 4-PS3-2 4-PS3-4 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	PS3.A PS3.B ETS1.A ETS1.B ETS1.C	Energy and Matter Influence of Engineering, Technology, and Science on Society and the Natural World	1, 3, 6
Grade 5	5-PS2-1 3-5-ETS1-1 3-5-ETS1-2 3-5-ETS1-3	PS2.B ETS1.A ETS1.B ETS1.C	Cause and Effect Energy and Matter	1, 3, 6, 7
Grades 6-8	MS-PS3-2 MS-PS3-5 MS-ETS1-1 MS-ETS1-2 MS-ETS1-3 MS-ETS1-4	PS3.A PS3.B ETS1.A ETS1.B ETS1.C	Energy and Matter Structure and Function	1, 2, 4, 7

Visit thetech.org/fieldtrips for more information on field trip offerings, booking information, and more!

The Tech Interactive
thetech.org