Charlie the Mechanical Engineer: Extreme Theme Parks

Who is Charlie?

Hi, I'm Charlie. I am a mechanical engineer. Mechanical engineers design, build, and test machines. For example, mechanical engineers build and test elevators and air conditioning systems.

I specialize in designing roller coasters! How fun does that sound?

A roller coaster is a thrill ride where riders sit in a car that travels along tracks that go up hills, take sharp turns, and can even go upside down. Roller coasters are typically constructed of either wood with steel rails or totally from steel.

What I'm Working On

I work for an engineering design firm in Texas. Right now, I am working on designing a new steel coaster that will have some of the tallest and fastest drops in the U.S. In order to make this the most exciting coaster it can be, I am going to visit some other theme parks to ride a few of the most popular coasters. I will choose my favorite parts of each coaster and combine them to make the best roller coaster ever!

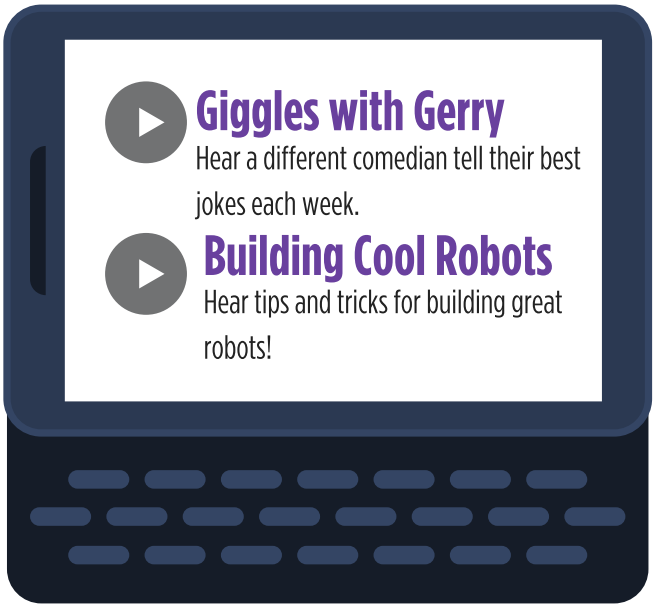
Did You Know?

There are over 450 amusement parks in the United States alone! Building a new roller coaster can take anywhere from 8 months to 5 years. New coasters can cost an average of 8 million dollars.

My Podcast

Right, now, I am starting a podcast so I can share my journey of how I am going to design the new roller coaster. How cool would it be if I won a world record for the tallest (and safest) roller coaster?

Podcasts are audio files that are available on demand (at any time) to listeners. Listeners can access podcasts through different apps, like iTunes. You can use your computer, phone, or tablet to listen to them. Podcasts cover all kinds of topics, from comedy to science. Engineers use podcasts to communicate their research or current projects with other engineers or those who are simply interested in engineering.

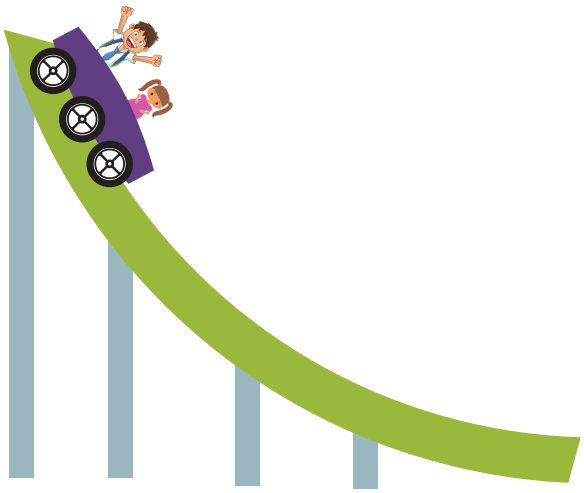


My podcast will talk about the pros and cons of each coaster I design and also talk about some of the engineering factors involved in each coaster. Usually my subscribers are either engineers or just roller coaster enthusiasts who want to hear about which coaster they should try out next.

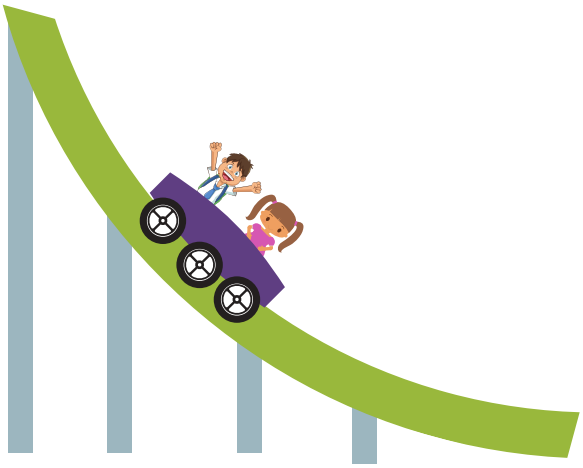
Recording a New Podcast Episode

Today, I am recording a new podcast episode on the importance of gravitational potential energy in the design of roller coasters. Gravitational potential energy is the stored energy in an object due to the mass and height of the object.

This means that the higher an object is, the more gravitational potential energy it has.



More Gravitational Potential Energy



Less Gravitational Potential Energy

Also, the heavier an object is, the more gravitational potential energy it has.

More Gravitational Potential Energy

Less Gravitational Potential Energy

I am excited to talk about this because I think that the coasters that have the most gravitational potential energy are the most thrilling! More gravitational potential energy at the top of a drop means more kinetic energy to make the cart go faster at the bottom and through loops!

Gathering Information for the Episode

Last week, I rode the three tallest roller coasters in Ohio so I could test out the gravitational potential energy of each one. My favorite coaster had two big drops. The first drop was 300 feet and the second drop was 180 feet!

A roller coaster cart at the highest point of a drop will have the most stored potential energy. As the cart goes up and down throughout the ride, its potential energy also goes up and down.

Where on this track, would the coaster have the most potential energy? Where would it have the least potential energy?

My New Design

For my new roller coaster design, it is really important to make sure I build that first climb high enough to store potential energy for the ride. That way, the cart does not get stuck somewhere on the track. As the cart goes up higher, more potential energy is stored and gravity can pull it back down a further distance. I am using my computer to plan my new coaster's design.

Roller coasters that have high speeds or loops need more potential energy to start than smaller roller coasters. If a roller coaster does not have enough stored energy, the cart will never make it through a loop. The differences in height along the roller coaster are what make roller coasters so much fun. When a roller coaster is really tall, the gravitational potential energy is converted to kinetic energy. Then, the ride goes faster.

Recording and Uploading Podcast

Here is the script I am going to read from for this episode:

Hey! Thanks for joining us today on another episode of Charlie's Crazy Coasters. Today we will be talking about how the gravitational potential energy affects the fun factor of a roller coaster. I have recently tested out several popular coasters and have some news to share. The tallest drops produce the fastest coasters. This is because the higher the cart is, the more stored energy it has. For example, if the cart reaches 300 feet, it will have a lot of stored energy that can take you up more hills and through loops. If the cart only reaches 100 feet, it won't have as much stored energy to use for the rest of the ride.

After I have recorded my podcast, I will upload it to the Internet, including posting links on my social media, so all of my listeners can stream it or download it for later!

Name: _____

Introduction to Kinetic and Potential Energy

A mechanical engineer designs, builds, and tests machines. Some mechanical engineers work for theme parks and design roller coasters.

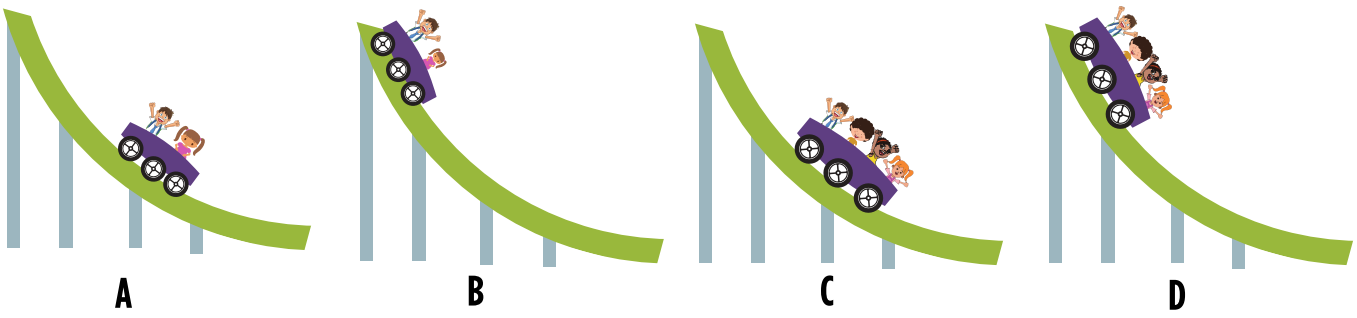
Today, you will imagine you are a mechanical engineer. Follow the steps below to learn about roller coasters. Then analyze a theme park's roller coaster designs and tell them whether you think the rides will work in real life!

Step 1: Read article and answer questions

Read the article attached. Then, answer the questions below.

1. What is gravitational potential energy?

2. Look at the four pictures. Which car has the most gravitational potential energy? Which car has the least gravitational potential energy? Explain your reasoning.



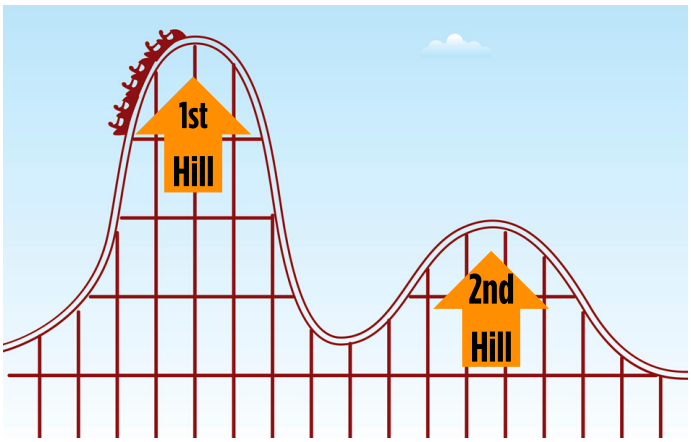
Name: _____

Introduction to Kinetic and Potential Energy

3. What is kinetic energy?

4. True or false: The mass of an object OR the height of an object affect the potential energy, but not both. Explain.

5. Look at this picture. Why does the first hill need to be taller than the second hill for the cart to not get stuck on the ride?

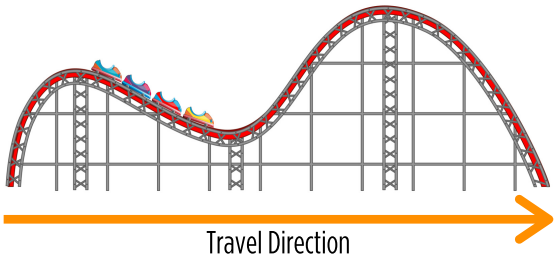


Name: _____

Introduction to Kinetic and Potential Energy

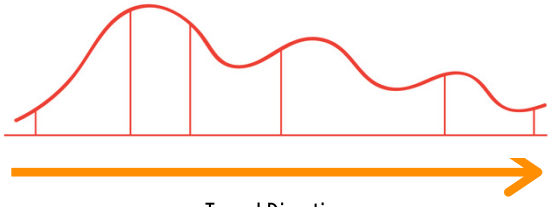
Step 2: Help a theme park

Imagine a theme park has sent you three drawings of roller coasters that they want to add to the theme park. Below, each box has a drawing. Look at the drawings and decide whether the carts will be able to finish the ride without getting stuck.



Will the cart be able to finish the ride without getting stuck? Explain your reasoning.

Will the cart be able to finish the ride without getting stuck? Explain your reasoning.



Will the cart be able to finish the ride without getting stuck? Explain your reasoning.

Will the cart be able to finish the ride without getting stuck? Explain your reasoning.

Name: _____

Introduction to Kinetic and Potential Energy

Step 3: Design your own ride

Design your own roller coaster ride that has at least three loops. Don't forget that in the real world there is friction so the cart will lose a little energy as it races through the ride. Make sure you design your roller coaster so the carts will be able to make it around each loop! Draw your roller coaster in the box below.