



Roller Coaster Physics

A roller coaster ride is a thrilling experience that involves a ton of physics! A roller coaster is a machine that uses gravity and inertia to send a train of cars along a winding track- oftentimes with loops, curves, and hills. **Gravity** is the force that pulls us down, while **inertia** is an object's ability to resist change- so if an object is in motion it will stay in motion and if it is resting it will stay resting until a force comes along to change that!

Roller coasters begin by being hoisted up by chains (or another mechanism) to the highest point, which exerts force on the train cars. Once the coaster reaches the top, the cars possess a large quantity of **potential energy** which is the stored energy an object has because of its position. From here, gravity takes over! The rest of the ride is then an amazing experience of energy transformation!

Once the roller coaster is heading down the track, the potential energy is lost and it gains **kinetic energy**. Kinetic energy is the energy of motion, and so long as the object is moving at the same **velocity** (speed in one direction) it will maintain the same energy. A roller coaster ride is full of ups and downs, which means it is constantly gaining and losing energy. Have you ever ridden a roller coaster before and felt that rush as you rocket down a hill, but then slow down as you climb into the loop - only to speed up once you have passed the highest point of the loop and begin to descend? That is physics at work!

Now, this explanation may seem a bit complicated at first (or maybe not), but the best way to really explain and gain an understanding of a scientific topic is to experiment! So let's get started!



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Now, this explanation may seem a bit complicated at first (or maybe not), but the best way to really explain and gain an understanding of a scientific topic is to experiment! For this activity, you will be designing and constructing your own roller coaster using inexpensive materials found at your local hardware store. **Pipe insulation (sold in 6ft tubes), masking tape, a cup, and marbles** are all that you will need for for this fun project! You can cut the tubes length wise and then into various sizes to create slopes, loops, hills, curves, and more! Remember, when keeping in mind potential and kinetic energy, the roller coaster will never be able to go higher than where it originally started from - so be sure to begin your roller coaster at a high point!

Getting Started

This engineering project is all about trial and error, designing and redesigning, testing and retesting, and experimenting over and over! The only necessary goal of this project is to get your marble to complete the track and end up in the cup at the end of the roller coaster ride! Strive for loop-de-loops, spirals, curves, and speed! Take a look at the pictures below for some ideas. Have fun!

