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**Title:** Chapter 3: Rolling in a Coaster.

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**Abstract:** This chapter explains the physics of riding a roller coaster. All roller coasters run on the principle of gravity. G-force is one measure of gravity. The chapter includes a discussion of each type of force that your body experiences during various stages of the ride including potential energy, kinetic energy, gravity, inertia and centrifugal force. (Copyright applies to all Abstracts)

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### Chapter 3: Rolling in a Coaster

All coasters run on the same fuel-gravity. Gravity is the force that attracts a small object towards a larger one. The largest object in our world is the earth itself. Gravity pulls people, buildings, trees, and roller coasters downwards, toward the center of the earth.

#### G-force

One measure of gravity is called a g-force. When you are standing still, gravity pulls on you with a force of 1 g-force, or 1 g. And when you are moving, the force of inertia keeps you moving. Inertia resists any change in speed or direction.

#### How Many G's?

At the start of the ride, a chain attached to a motor drags the train up the tallest hill. As the coaster rises, it stores up potential energy. At the top, the chain lets go of the cars. This is the famous first drop that all coasters have. On the first drop, the force of gravity converts the potential energy into kinetic energy.

#### Up and Down, Back and Forth

When the coaster rolls down a high, steep track, the cars gradually accelerate. The higher the track, the faster the acceleration. Faster and faster, the cars and your body are moving back down towards the surface of the earth.

When the coaster suddenly turns upward again, you feel the effects of inertia--the force that resists the change in direction. Inertia increases the g-forces on your body, pressing you down in your seat. You actually weigh more.

But when you're racing upward to the top of the hill, inertia again takes effect. It is pushing the cars--and you--upward. This decreases the g-forces when the coaster turns back down the hill. You feel negative g's, and you weigh less than you normally do. If you weren't strapped in, you might float right out of your seat.

One other kind of force is at work during a roller coaster ride. Centrifugal force pushes things that are moving in a circle outward, away from the center of the circle. It affects you when the cars turn around a curve or go upside down in a loop. If the coaster turns sharply to the left, centrifugal force pushes you outwards, to the right. If a coaster turns right, your body moves to the left.

As the coaster rolls back into the station, all the potential energy that built up on the lift hill is gone. The kinetic energy reaches zero. As motion slows, inertia no longer has any effect, and the g-forces return to 1. Your weight returns to normal, and the coaster comes to a smooth stop.

When you ride a roller coaster, you are feeling all these forces--potential energy, kinetic energy, gravity, inertia, and centrifugal force--work on your body.

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By Gil Chandler

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