

**Enrichment****LESSON 3**

## Amusement Park Physics

Every year, scientists from NASA participate in Physics Day at amusement parks across the United States. The scientists work with students in grades K–12 to help them understand the physics of amusement park rides.

“Students really get into experiments when an amusement park is the laboratory,” said Richard DeLombard, project manager for Exploration Outreach and Education at NASA’s Glenn Research Center. “It makes physics real to them.”

### Roller Coasters

On Physics Day, which usually takes place in the spring, DeLombard and his team use Cedar Point in Sandusky, Ohio, as their teaching laboratory. Students in the program go on roller coasters, among other rides. NASA scientists help the students relate their experience to that of astronauts. For example, as a roller coaster heads toward the bottom of a hill, the force of gravity and the cars’ acceleration press students back in their seats. For similar reasons, astronauts are pressed back in their seats during the launch of a spacecraft.

### Acceleration Patterns

As part of Physics Day, students try to identify the acceleration patterns of different

rides. For example, at the beginning of a typical roller-coaster ride, the cars of the roller coaster are pulled by a chain to the top of a hill. Neither the speed nor the cars’ direction changes, so the cars have no acceleration.

As the first car noses over the hill and begins to go down, acceleration increases slightly. Acceleration continues to increase with each car that crests the hill. It is highest when all the cars are streaking down the hill—the steeper the hill is, the greater the acceleration will be.

When the cars are evenly distributed at the bottom of the hill, there is a moment of zero acceleration. As the cars start over the next hill, acceleration does not spike again until the cars descend the hill.

### Fun with Physics

Of course, most roller coasters are not made of simple hills and valleys. They have twisting loops and sharp turns with complicated acceleration patterns. The students who participate in Physics Day must pay close attention as they race upside down and sideways along the roller-coaster track. But the students don’t seem to mind. As a NASA official points out, learning really can be fun.

## Applying Critical-Thinking Skills

**Directions:** Answer each question or respond to each statement.

- Determine** whether a roller-coaster car has acceleration as it goes through a turn. Explain.
- Give an Example** In addition to a launch, where else might the astronauts feel the acceleration of their spacecraft?