Chapter 14

ENRICHMENT

Use with Section 3

• What is energy?

Roller Coaster

It's a warm day at the amusement park and you are standing in a crowd of people waiting in line to ride what the sign says is the "World's Greatest Roller Coaster!!!" You can hear the clanking of the chain that lifts the cars to the top of the first hill and then the passengers begin screaming as they plummet down the hill and swing around the first curve. And you begin to wonder. There's no engine. So what makes a roller coaster go?

The answer is simple. A roller coaster is a gravity-driven train. The forces that make it run are gravitational potential energy and kinetic energy. As the coaster rises, it is pulled away from Earth, in the opposite direction from gravity. That means that the coaster is storing up potential energy. The higher the first hill, the more potential energy the coaster stores. Then the coaster begins to fall. Gravitational energy becomes kinetic energy, the energy of motion. But the coaster has stored up so much potential energy that there's plenty left when it reaches the bottom of the first hill. The American Eagle coaster comes down its first hill at about 105 km/h. Momentum carries the cars around a curve and up another hill. Kinetic energy is causing the coaster to move up, and at the same time the coaster is gathering more gravitational potential energy to continue the ride.

But energy is sometimes a losing game. Some of the energy is lost to sound and to heat as the wheels move along the tracks. That's why the coaster's first hill is always the highest. The Rattler, a wooden coaster at a park in Texas, pulls its passengers almost 50 km into the air on the first hill before dropping them down. The aim is to gather up as much potential energy as possible. Because the Rattler goes so high, it has enough energy to deliver one of the longest rides in the country for a wooden roller coaster. As the Rattler races along its tracks, there is a constant, smooth shift from gravitational potential energy to kinetic energy and back again.

People who design roller coasters know that they have to balance the forces of physics in order to keep a coaster moving, make sure that it has enough energy to climb the hills and make the turns—and shake up the passengers along the way. So, modern designers use computers, which can figure out the forces at work and test a design long before a structure is ever built. With computers at hand, roller coaster designers can try to build "The World's Greatest Roller Coaster" every time they take on a new project.

1. Why is the first hill of a roller coaster the highest one in the course?

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2. What is the role of kinetic energy in a roller coaster?

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