Energy along a Roller Coaster

Reading for Authentic Assessment

PART1

Why should you have a large hill at the start of the roller coaster?

Where should the most friction be located? Why? (also- where should the *least* friction be?)

How does the roller coaster demonstrate the Law of Conservation of Energy?

Although roller coasters have changed quite a bit since the ride became popular, the basic design principles have remained the same, since the beginning. That is because whether the ride consists of an old wooden track with a few hills and turns, or a modern steel track with a variety of corkscrews and loops, all roller coasters rely on the same principles of physics.

The Law of Conservation of Energy states that within a closed system, energy can change form, but it cannot be created or destroyed. In other words, the total amount of energy remains constant. On a roller coaster, energy changes from potential to kinetic and back again many times over and over the course of the ride.

Kinetic energy is energy that an object has because of its motion. All moving objects possess kinetic energy, which is determined by the mass and speed of the object. In a roller coaster, the forms of kinetic are mechanical, sound and thermal. Potential energy is the energy an object has as a result of its position. Potential energy is stored energy that has not yet been released. Both these forms of energy can be dynamically changing from one to the other within a closed system, like that of a roller coaster. Gravitational potential energy is energy that results from an object's position in a gravitational field, and is equal to the object's mass multiplied by its height. For example, a roller coaster car possesses increasing gravitational potential energy as it is raised higher and higher along a track, due to the earth's gravitational field.

For most roller coasters, the gravitational potential energy of the cars at the peak of the first hill determines the total amount of energy that is available for the rest of the ride. Traditionally, the coaster cars are pulled up the hill by a chain; as the cars climb, they gain potential energy. At the top of the hill, the cars have a greater deal of gravitational potential energy relative to the bottom, equal to the mass of the car times the height of the hill. When the cars are released

from the chain and begin coasting down the hill, potential energy transforms into kinetic energy until they reach the bottom of the hill. As the cars ascend the next hill, some kinetic energy is transformed back into potential energy. Then, when the cars descend this hill, potential energy is again changed back into kinetic. This transformation between potential and kinetic continues throughout the ride until it comes to a rest at the end.

In reality, the transformation between potential and kinetic energy is not perfect. Friction is constantly at work, acting on the cars as they roll along the track. Potential energy is dissipated in this way throughout the course. Kinetic mechanical energy is not lost however. Rather it is transformed into thermal energy and sound due to the friction, which can be detected as an increase in temperature along the track and the roller cars' steel wheels. Because of friction between the coaster cars and the track, along with air resistance as the cars move forward at high speed, the amount of mechanical energy available decreases throughout the ride. This is why the first hill must be always be tallest. The amount of friction engineered into the track should typically be minimized during the ride and greatest toward the end of the track. In this way the riders can go fast along the track and have fun, and yet still slow down and come to a safe stop at the end.

Writing Assignment Details –part of your Authentic Final Assessment in this course is as follows.

Your challenge - How to build, construct and engineer a faster roller coaster?

- In the boxes below, form a first draft for your argument.
- Your essay must contain these four paragraphs (minimum).

Paragraph structure

- See the box graphic org. details below – write and/or take notes for your rough draft here.
- Then expand on your ideas and include details about your roller coaster and how you might make it faster, more exciting, exhilarating, perhaps include a theme, etc.

Once you have completed hashing out your ideas in the boxes you can then continue by composing more complete thorough well thought out essay paragraphs on Microsoft Word Office 365, or word processor of your choice as long as it is typed. Save your work.

NAME _____ PER_____ DATE_____ MAILBOX_____

Potential Energy – What is the main idea? How does it relate to a roller coaster? **3-5 sent. Minimum**

Kinetic Energy – What is the main idea? How does it relate to a roller coaster? **3-5 sent. Minimum**

Thermal Energy & Friction – What are they? How do they relate to a roller coaster? **3-5 sent. Minimum**

L.o.C.o.E – What is it? How does it relate to a roller coaster? **3-5 sent. Minimum**