CALIFORNIA STATE SCIENCE FAIR
2013 PROJECT SUMMARY

Name(s)
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Project Number
J1807

Project Title
Speed vs. Thrills: A Study of Potential and Kinetic Energy

Abstract

Objectives/Goals
A roller coaster is amazing when it has both high speeds and thrills, like those offered by a vertical loop, but does one have to be sacrificied for the other? To test this I dropped marbles, of the same weight, from the same height, therefore having the same potential energy (E potential = .0938) on a roller coaster track. I used tracks with three different diameter vertical loops, and calculated the speeds and kinetic energies. My goal was to see if increasing the diameter of the loop will proportionally change the kinetic energy, as measured with a decrease in the speed of the marble, and make predictions about other sizes of loops and marbles.

Methods/Materials
I created three roller coaster tracks using 3.6576 meter sections of foam pipe insulation and duct tape. Each track began 1.26 meters high, attached to a step ladder, and the three loops had diameters of 20 cm, 30 cm, and 40 cm. The marble used was 0.0076 kg and was dropped 30 times, for 30 trials, for each of the loop sizes. The speeds were averaged and then the kinetic energy of each loop was found using the formula E kinetic = 1/2 mass times velocity squared.

Results
I calculated a ratio of kinetic to potential energy to measure the differences between each loop size. My results were that the 20 cm loop's ratio of kinetic energy to potential energy was 20.1%, the 30 cm loop's ratio was 17.9%, and the 40 cm loop's was 16.4%. This showed a difference of almost 2% in the ratio as the diameter of the loop was changed by 10 cm.

Conclusions/Discussion
From these results one could extrapolate that a loop of 50 cm would have a ratio of kinetic to potential energy 22%, and so on. This proved that you do give up a proportionate amount of speed for the thrill of a bigger loop.

Summary Statement
I built 3 models of roller coaster tracks, with 3 different sized vertical loops. I measured the speed, calculated the kinetic energies, and made a ratio with the potential energy to show the ratio of speed to thrills.

Help Received
My father helped me stabilize the track so I could run my trials. My mother helped me time the trials, and do the standard deviations in Excel.