Swinging Physics

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One of the playground activities that provides children with a great deal of pleasure is the common swing. Although simple in nature this application of the pendulum covers a wide variety of topics in physics. This experience is designed to determine what nature of the motion provides the most thrilling experience (fun) for the riders. Part Two of this experience asks the student to determine which factors affect the time it takes for a swing to oscillate back and forth.

Part One (handout begins)

Fun Factor
Imagine you are riding in a car or train or airplane. Think about the times that you feel the least stable, perhaps the most thrilling parts of the ride. Circle the phrases below which describe the time when the riding experience is the most thrilling.

At Rest
Speeding Up
Constant Slow Speed
Constant Fast Speed
Slowing Down
Travelling Around A Curve
Travelling Over a Bump
Travelling On a Smooth Road

What is happening to the speed of the vehicle in each of the thrilling sections of travel?

Why does a child feel the thrill while swinging? Answer this question by relating the swinging motion to the thrilling vehicular motion.

Using the “Pendulum Lab” PhET Simulation. Try to model the movement of a swing and measure the “thrill factor”.

Open the Simulation and experiment a bit with the controls. Then use the controls to help you answer the following questions.

Questions:

Michi says that when she was a child she would wrap the chains of the swing over the support bar a few times making the swing shorter. She claims that this mad the ride much more thrilling.

John said that he had a swing that was tied to a very high branch of a tree. He claims this really long swing was more thrilling than a shorter one.

These claims seem to disagree with one another. Whose argument do you find more appealing? _____ What reasoning do you use when choosing?

SIMULATION

Use the PhET simulation to try to provide some modelling evidence to determine how the length of a pendulum (swing) determines the thrill of the rider.

DATA:

Use your data from above and make a statement of your findings as they relate the length of the swing to the thrill of the rider.

At what point along the swinging path would the rider feel the greatest thrill?

Throughout this experience, what physical quantity have you been analyzing to relate to the concept of "thrill"?

Follow-Up Question:

Which planet would provide for the most thrilling swing ride?_____Support your choice with data from the Simulation.

Part Two: Factors Influencing Swing Time

John remembers swinging as a child and once in awhile a brother or sister would jump on the swing and two people would swing together. Do you think that this would increase, decrease, or not affect the time it would take for the swing to oscillate back and forth? Include the reasoning for your choice.

SIMULATION
Use the photogate timer to model the situation above to help you determine how this change in mass would affect the time of oscillation.
Pheta= Data using PhET simulations:

Use your pheta to describe the affect of mass on the time of oscillation,

How could you use a stopwatch to measure the same time the photogate measures?

Use the PhET simulation to determine the effect of pendulum length on the time of oscillation. Use your pheta to describe the effect of length on the oscillation time.