Pendulum Rides

<u>Featured Rides:</u> **Xtreme Skyflyer, Endeavor, Delirium** (<u>*NOTE:*</u> *It is not necessary to ride the Xtreme Skyflyer in order to complete this experiment. All measurements can be made from a ground observation point. The cost of riding the Xtreme Skyflyer is <u>not</u> included in park admission cost.*)

<u>Materials Needed:</u> Protractor, stopwatch, calculator, horizontal and vertical accelerometers (needed only if ride is actually ridden by experimenter)

<u>Hints:</u>

1) The period (T) of a pendulum is the amount of time it takes to make one complete vibration (back and forth). It can be calculated using this formula where L is the length of the pendulum: $T = 2\pi\sqrt{\dfrac{L}{g}}$.

2) Use a protractor to measure the angle between the highest swing of the pendulum and horizontal (through pivot point of the pendulum). The maximum height to which the pendulum rises can then be calculated using the formula:

<u>Questions to Be Answered:</u>

Intermediate:

1) What is the estimated length of the pendulum? (Verify the actual length with the ride operator, if possible, before making calculations using pendulum length as a factor.)

2) Does the ride reach its theoretical (calculated) maximum height? If it does not, or if it exceeds the maximum (which can happen), what produces this difference?

Advanced:

3) How is this type of ride similar to a roller coaster? How is it different? Be specific and give at least 3 similarities and 3 differences between these rides.

4) What is the maximum velocity attained by the pendulum? How does this measurement compare with the theoretical maximum velocity based upon conservation of energy?

<u>Investigative Steps:</u> Describe your procedure here.

<u>Data and Observations:</u> Record and organize your results here.

<u>Calculations and Conclusions:</u> Explain your answers to the questions here.

<u>Going Further:</u> Does the total mass of the riders affect the behavior of the ride? Should it? Design and conduct an experiment to test this hypothesis.

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