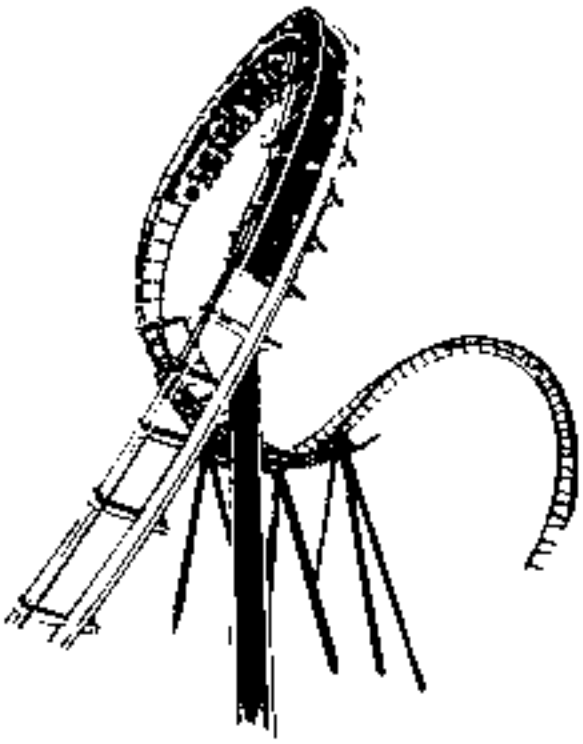
The Sidewinder



We know that, under ideal circumstances, the potential plus kinetic energies of a coaster at the top of a hill (using the bottom of the hill as the reference level) will equal the kinetic energy of the coaster at the bottom of that hill. But, again, this is NOT an ideal situation!

Question 1: How does the kinetic energy, E_K, of the Sidewinder at the bottom of the starting hill compare to its potential energy, E_P, at the top of the starting hill? (Since the Sidewinder begins its run at rest, it has only potential energy at the top.)

Prediction 1: The E_K at the bottom of the ride will be:
(Choose one)

(a) equal to the E_P at the top.
(b) about 70% of the E_P at the top.
(c) about 50% of the E_P at the top.
(d) about 30% of the E_P at the top.

Try It !!: We can answer the Question as follows.

(I) Find the E_P of the coaster at the top of the starting hill using the data given in the Engineering Specifications. We're choosing the bottom of the hill to be the reference level where $E_P = 0$ J.

$E_P = m \bullet g \bullet \Delta h =$ _____ Joules

(II) First, determine the speed at the bottom of the hill by timing how long it takes for the complete length of the coaster train to pass a point at the bottom of the hill (just where the track begins to level off) then calculate the kinetic energy.

t = _____ s v = length of the train / time = _____ m/s

$E_K = .5 \bullet m \bullet v^2 =$ _____ Joules

Observations/Conclusions:

(1) Calculate the percentage. (100 % • E_K/E_P)?_____

How does the E_K at the bottom compare to the E_P at the top? _____

_____

(2) Which prediction was the closest? Was yours?_____

_____

Question 2: The critical speed for an object moving in a vertical loop is the slowest speed the object can be moving at the top of the loop and not fall out. At this speed the rider would feel weightless (no pressure on your seat). When in the loop of the Sidewinder, is the coaster moving at the critical speed or higher? If higher, how many g's of acceleration do you think the rider is experiencing?

Prediction 2: The coaster is moving (at, faster than) the critical speed. (Choose one.)

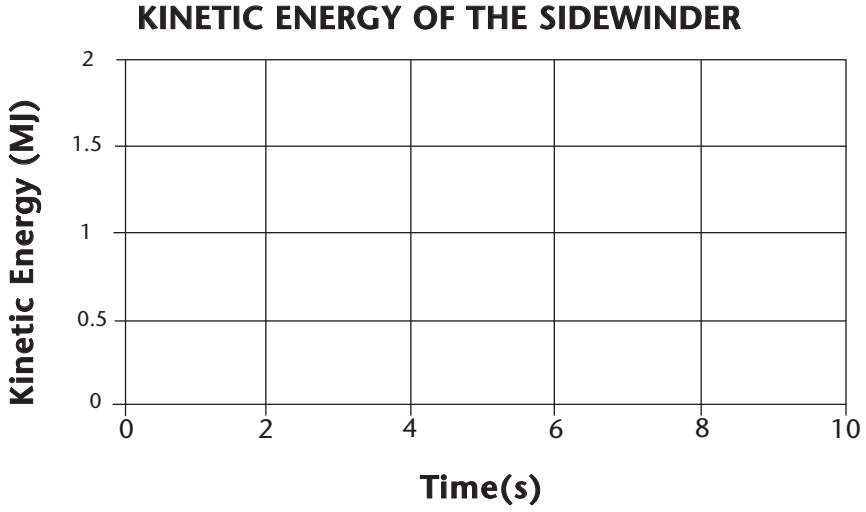
If 'faster than' how many g's do you think you'll experience? _____ g's

Try It !!: The easiest way to check this out is to measure it using the vertical accelerometer. (HINT: Have your partner yell 'NOW' when you are at the top of the ride - it's hard to tell when reading the accelerometer!)

Observation/Conclusion: What did you find out? _____

_____

Graph It !!: Sketch a graph below that shows the Kinetic Energy of the coaster as it travels backwards from the high point of the second lift through the loop to the end of the loop.



Engineering Specifications:

Height of the second hill: 35.5 meters
Mass of the full train: 8260 kg
Length of train: 18.3 meters $g = 9.8\ m/s^2$