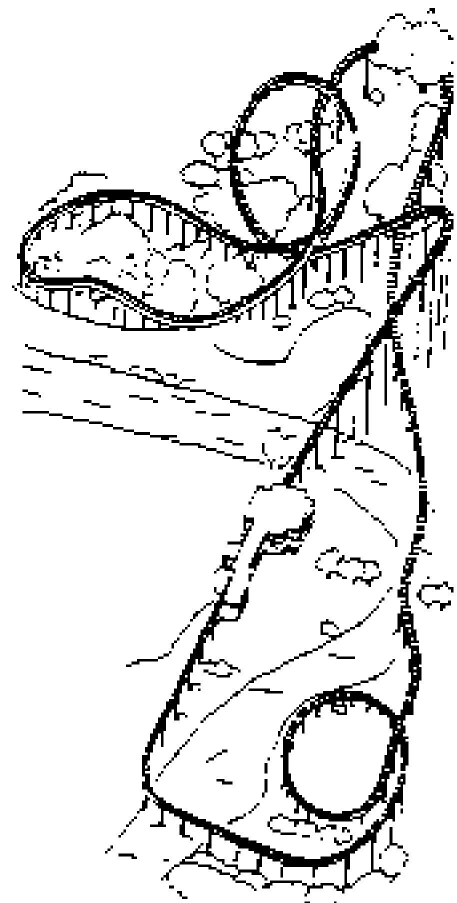
SOOPERDOOPERLOOPER

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 LOOPER at the bottom of the first hill compare to its total energy, E_T, at the top of the first hill? (The kinetic energy at the top of the hill is not zero, so it must be considered!)



Prediction 1: The E_K at the bottom of the ride will be:
(Choose one)
(a) equal to the E_T at the top.
(b) about 90% of the E_T at the top.
(c) about 60% of the E_T at the top.
(d) about 40% of the E_T at the top.

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

(I) <u>Total Energy at the top</u>:

(a) First, find the E_P of the coaster at the top of the first hill using the data given in the Engineering Specifications. We're choosing the bottom of the hill to be the reference level where $E_P = 0$ Joules.

$E_P = m \cdot g \cdot \Delta h =$ ____________________ Joules

(b) Then, find the kinetic energy, E_K, at the top. Determine the speed at the top of the hill by timing how long it takes for the complete length of the coaster train to pass the highest point of the hill then calculate the kinetic energy.

t = ______ s   v = length of the train / time = ________________ m/s

$E_K = .5 \cdot m \cdot v^2 =$ __________________ Joules

(c) The total energy at the top of the hill, E_T, is the sum of the potential and kinetic energies:

$E_T = E_P + E_K =$ ______________________ Joules

(II) <u>Kinetic energy at the bottom:</u>
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 the lowest point at the bottom of the hill then calculate the kinetic energy.

t = ______ s   v = length of the train / time = ________________ m/s

$E_K = .5 \cdot m \cdot v^2 =$ __________________ Joules

Observations/Conclusions:
(1) Calculate the percentage. (100 % • E_K / E_T)?__________________________________

How does the E_K at the bottom compare to the E_T at the top? ________________________

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

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Question 2: How many g's of acceleration will you feel
(a) at the bottom of the loop?
(b) at the top of the loop?

Prediction 2: What do you think?
(a) Acceleration at the bottom will be closer to (.5, 1, 2, 3,) g's. (Choose one)
(b) Acceleration at the top will be closer to (.5, 1, 2, 3,) g's. (Choose one)

Try It !!: Use the vertical accelerometer to answer the question. Record your readings below. (HINT: Have your partner yell "NOW" when you are at the bottom and again when you are at the top - it's hard to tell when reading the accelerometer!)
(a) Accelerometer reading at the bottom = __________ g's
(b) Accelerometer reading at the top = __________ g's

Observations/Conclusions: Were the readings what you expected? Why or why not?

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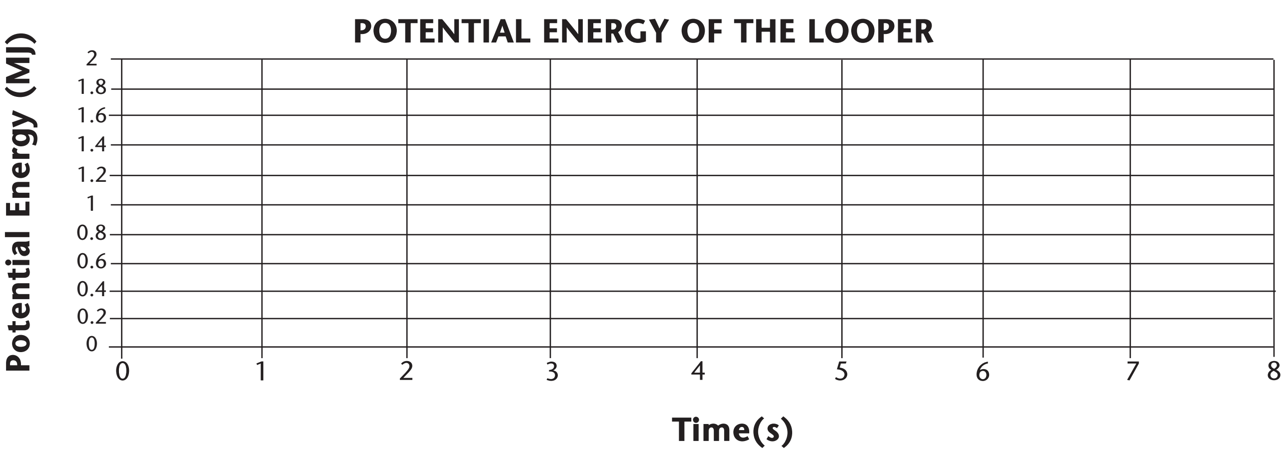
Graph It!!: Graph the Potential Energy of the coaster against Time from the top of the first hill through the loop to the end of the loop.



Engineering Specifications:

Mass of train (full) = 4300 kg
Length of train = 13 meters
Height of first hill = 25 meters   g = 9.8 m/s^2