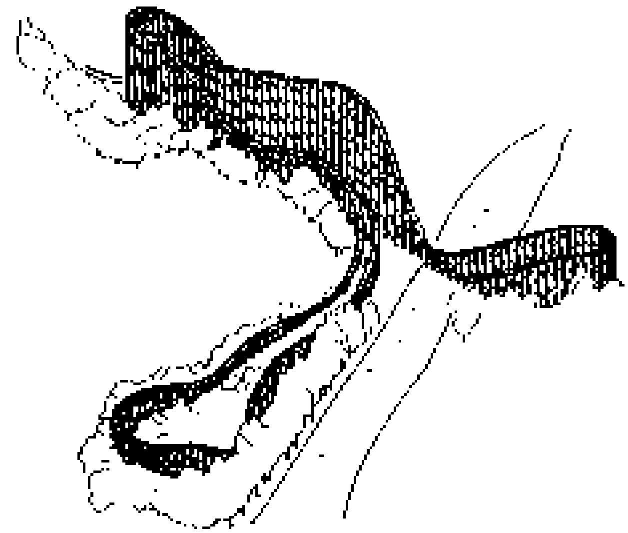
The Comet

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 Comet 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) Total Energy at the top:

(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.

$E_P = m \bullet g \bullet \Delta h =$ ____________________ 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

$E_K = .5 \bullet m \bullet v^2 =$ __________________ 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) Kinetic energy at the bottom:

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 = train length / time = __________ m/s $E_K = .5 \bullet m \bullet v^2 =$ _________ Joules

Observations/Conclusions:

(1) Calculate the percentage. ($100\% \bullet E_K/E_T$)?____

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

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

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Question 2: How does the vertical acceleration at the bottom of the second hill compare to the vertical acceleration at the bottom of the first hill?

Prediction 2: The acceleration at the bottom of the second hill will be:

(a) about the same as the acceleration at the bottom of the first hill.
(b) much less than the acceleration at the bottom of the first hill.
(c) much greater than the acceleration at the bottom of the first hill.
(d) a little less than the acceleration at the bottom of the first hill.
(e) a little more than the acceleration at the bottom of the first hill.

Try It !!: Use the vertical accelerometer to find out!

Acceleration at bottom of first hill = _____________ g's
Acceleration at bottom of second hill = _____________ g's

Observations/Conclusions: Which hill had the greater acceleration at the bottom?
Why is this true?____

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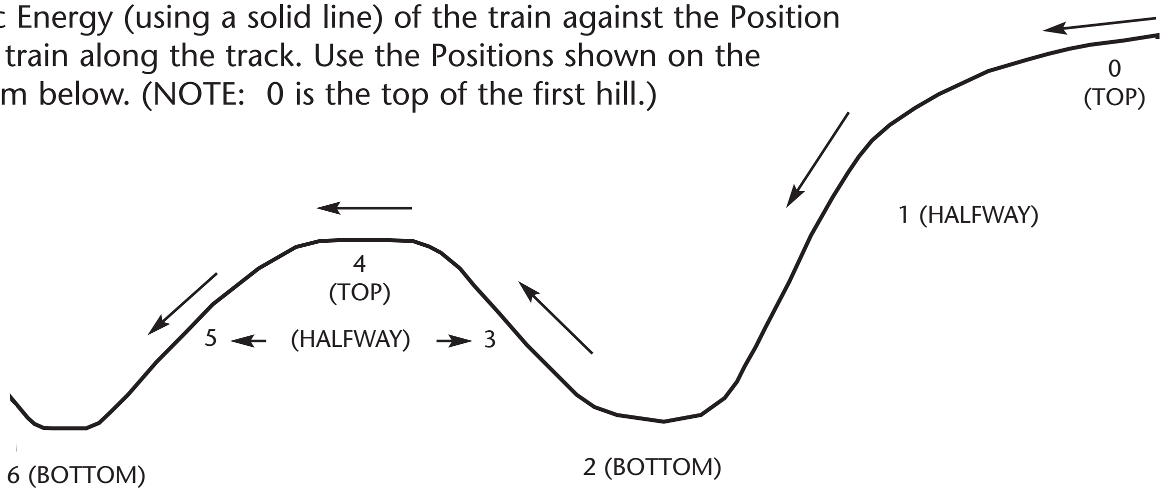
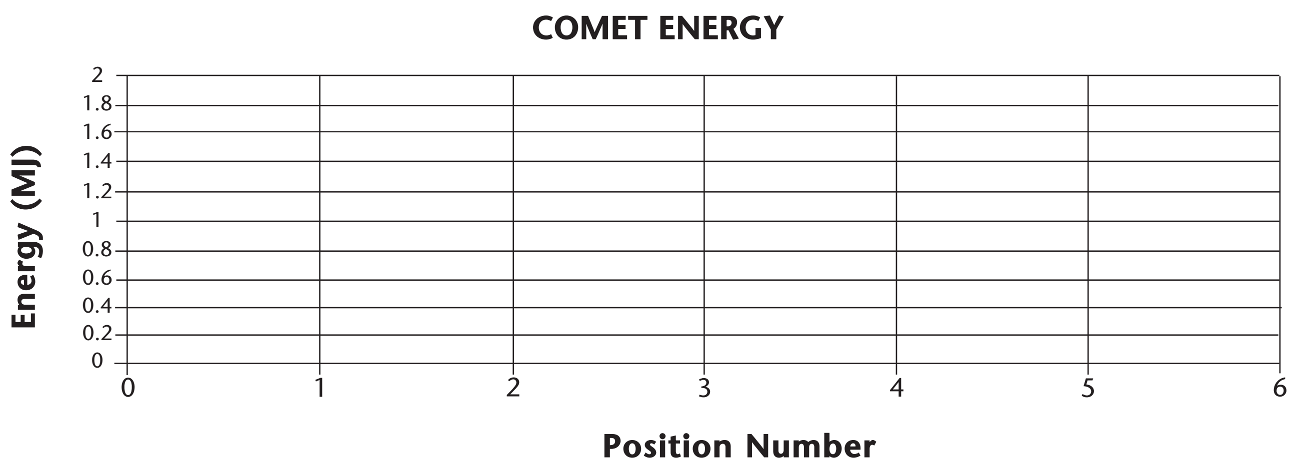
Graph It !!: Sketch a rough graph of the Potential Energy (using a dotted line) <u>and</u> the Kinetic Energy (using a solid line) of the train against the Position of the train along the track. Use the Positions shown on the diagram below. (NOTE: 0 is the top of the first hill.)





Engineering Specifications:

Mass of train (full) = 4300 kg
Vertical drop for the first hill = 24.4 meters
Length of train = 12.2 meters
$g = 9.8\ m/s^2$