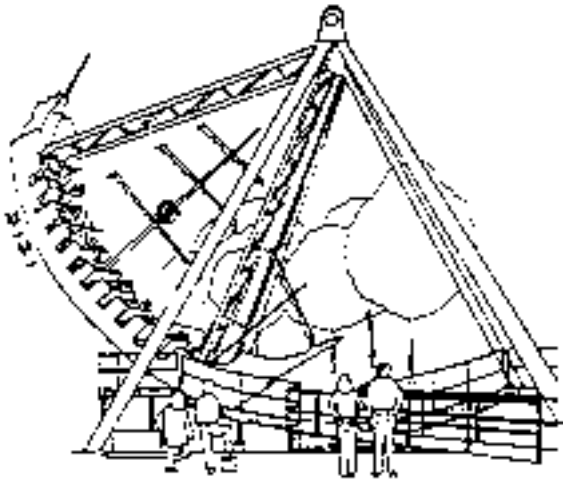
The Pirate



As you can tell, the HERSHEYPARK Pirate is a very large pendulum. In an ideal situation, the potential energy, E_P, at the top of the swing should equal the kinetic energy, E_K, at the bottom of the swing. However, this is NOT an ideal situation. (Why?)

Question 1: How does the E_P at the top of the ride compare to the E_K at the bottom of the ride?

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 in the following manner:

I) Find the E_P at the top using the height at the center of the boat and the mass of the boat. (See Engineering Specifications on the back)

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

II) We can find the E_K in two different ways (please do **both** ways).

(A) From the ground: Find the speed of the boat at the bottom by timing how long it takes for the complete length of the boat (from tip to stern) to pass the lowest point of the swing. Calculate the speed. Then calculate the E_K.

t = _____ s v = length/time = _____ m/s $E_K = .5\ m \bullet v^2$ = _____ Joules

(B) From the ride: Use the vertical accelerometer to measure the <u>maximum</u> acceleration (in g's) at the bottom of the ride.

Maximum acceleration = _____ g's $\bullet$ 9.8 m/s^2 = _____ m/s^2

We can use the centripetal acceleration equation to find the speed, v, and then calculate the E_K at the bottom of the ride. The <u>centripetal acceleration</u>, a_c, caused by the motion of the boat will be 1 g <u>less</u> than the maximum acceleration found above (since gravity causes a 1 g reading on the accelerometer when the boat is stopped at the bottom).

a_c = _____ g's $\bullet$ 9.8 m/s^2 = _____ m/s^2

$v = \sqrt{(a_c \bullet r)}$ = _____ m/s $E_K = .5\ m \bullet v^2$ = _____ Joules

Observations/Conclusions:

(1) How do the E_K from parts IIA and IIB compare?_____

(2) How does the E_K at the bottom compare to the E_P at the top? What percentage did you calculate (100 % • E_K/E_P)?_____

_____

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

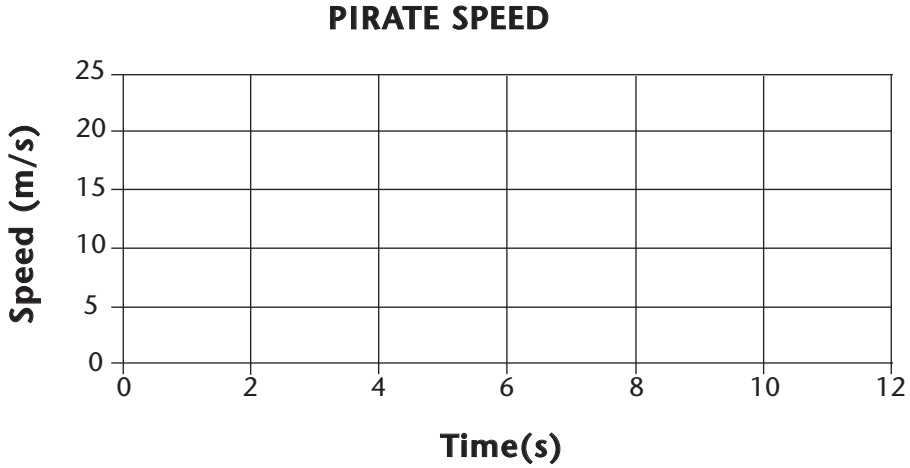
Question 2: How many g's of acceleration will you feel at the highest points on the ride?

Prediction 2: Choose one - Closer to (a) 0 g's (b) .5 g's (c) 1 g (d) 2 g's

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

Observations/Conclusions: Acceleration at the highest point on the ride is _____ g's.

Graph It !!: Draw a Speed-Time graph representing the motion of the Pirate (consider the center post) during at least one complete cycle of the ride.



Engineering Specifications:

Mass of Boat:	9500 kilograms	g = 9.8 m/s^2
Maximum height of center of Boat:	13.6 meters	
Length of Boat:	13.1 meters	
Radius of Pendulum:	13.6 meters	