TIDAL FORCE

Have fun riding, but, this is one ride where all measurements are taken from the ground!! Please be sure the accelerometers don't get wet on this ride. Let someone else hold your equipment while you ride.

Question: What is the acceleration of the boat as it is brought to a stop by the water and what is the stopping force applied by the water?

Prediction: Take a guess at how many g's of acceleration the riders undergo as the boat is brought to a stop.

Acceleration at the bottom = _____ g's

Try It!!: Use the following calculations.

(I) For simplicity, let's assume that the kinetic energy, E_K, of the boat at the bottom of the run is equal to the potential energy, E_P, of the boat at the top of the hill, we can calculate how fast the boat is moving at the bottom of the hill.

E_K at the bottom = E_P at the top = $m \cdot g \cdot \Delta h$ = _____ J

v (at the bottom) = $\sqrt{(2 \cdot E_K / \text{mass})}$ = _____ m/s

(II) Now, we need to time how long it takes for the water to bring the boat to a slow constant velocity. Use the stopwatch to see how long it is from the time the boat just enters the water until the time the boat stops making its big splash.

time = _____ s

(III) We'll estimate the speed of the boat when it stops splashing to be about 3 m/s. The acceleration of the boat (and its passengers) will be

$$a = \frac{3 \text{ m/s} - v \text{ (at the bottom of the hill)}}{\text{time to stop}} = \_\_\_\_\_ \text{ m/s}^2 \; [\div 9.8 \text{ m/s}^2 = \_\_\_\_\_ \text{ g's}]$$

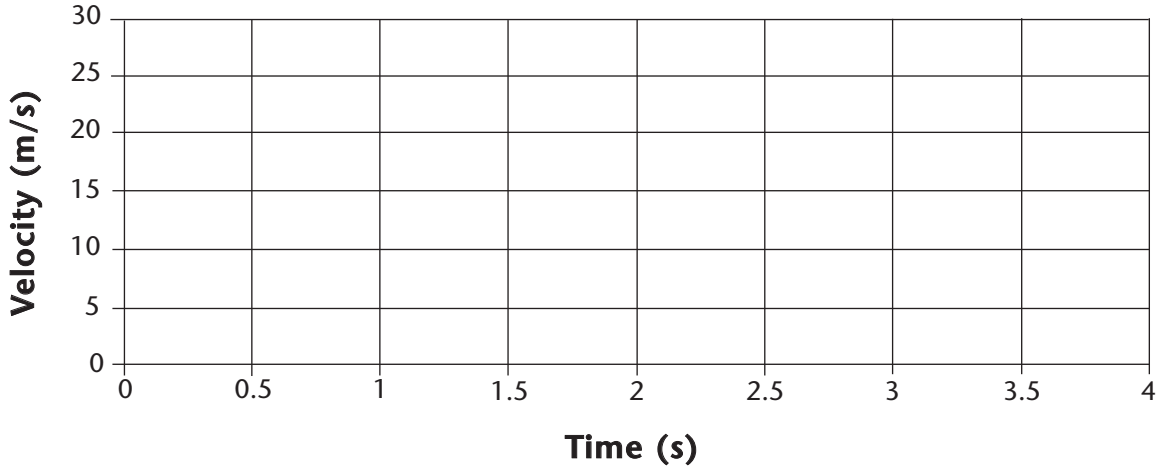
(IV) Using the mass of the full boat given in the specs and the acceleration (in m/s^2) from #III above, the stopping force of the water will be

$\sum F = m \cdot a$ = _____

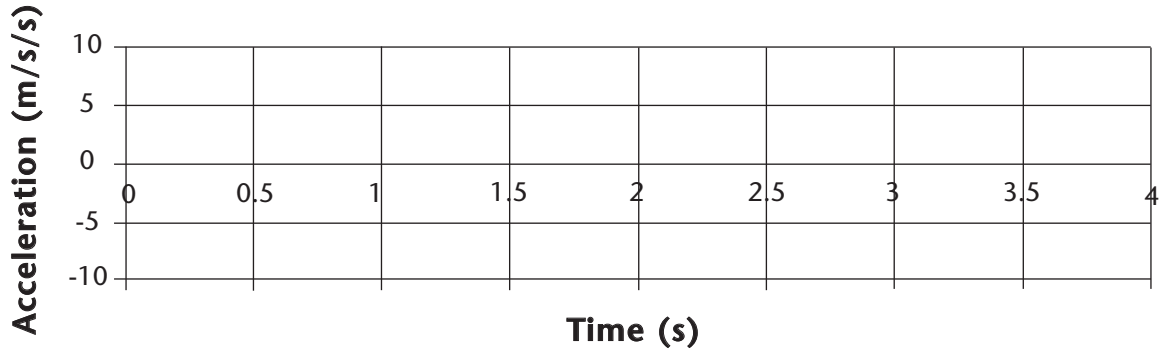
Observations/Conclusions: How many g's of acceleration does the boat undergo? How does the stopping force compare to your weight in N (your weight in pounds x 4.45)?

Graph It!!: Draw the Velocity-Time graph and the Acceleration-Time graph that represents the motion of the boat from the time the splash starts till the time the splash ends. Assume that 'forward' is the (+) direction and the acceleration is uniform.

TIDAL FORCE VELOCITY



TIDAL FORCE ACCELERATION



Engineering Specifications:

Mass of the full boat = 4100 kg g = 9.8 m/s^2
Height of the hill = 30 meters