

# RIP ROARING RAPIDS

Please note that this is a complex ride that is not the same from one trip to the next.



## DATA & OBSERVATIONS

### 1. Measurements and Observations While Standing in Line

Use the diagram on the last page to answer questions (a) and (b)

- \_\_\_\_\_ (a) Where does the boat have the greatest and least gravitational potential energy?
- \_\_\_\_\_ (b) Where does the boat have the greatest and least kinetic energy?
- \_\_\_\_\_ (c) Time for boat to travel up conveyer belt to the loading platform.
- \_\_\_\_\_ (d) Time for boat to travel complete course.
- \_\_\_\_\_ (e) Length of inclined conveyer belt.
- \_\_\_\_\_ (f) What factors seem to determine the speed of the boat?

### 2. Measurements and Observations After Exiting the Ride

From the bridge as you exit the ride, observe the boats as they descend from the top (map position 10) to the bottom (map position 11).

- (a) How does the PE of two different boats containing people of approximately equal mass compare at the top?
- (b) As boats descend, do they follow the same path to the bottom?
- (c) What has happened to their PE when they reach the bottom?
- (d) Does the change in PE depend on the path they take?

(e) What can we say about the speeds of the two boats?

(f) How would increasing the number of people in the boat affect its speed at the bottom?

## CALCULATIONS & QUESTIONS

### Given Information

Length of channel = 0.25 mile = 403 meters

Volume of water = 500,000 gallons = 1,900,000 liters

Flow rate = 33,000 gal/min = 120,000 liters/min

Weight of loaded boat = 1 ton = 8,900 newtons

Vertical height of conveyor ramp = 20 ft = 6.0 meters

1. Determine the average speed of the boat.

2. Determine the average speed of the current.

(Hint: use  $v = d/t$ , where  $d$  = length of channel and  $t$  = volume of water/flow rate)

3. What factors might account for the differences between the average speed of the boat and the current?

4. Determine the work needed to lift a boat to the loading platform.

5. How much power is expended in raising a boat using the conveyor ramp.

6. Determine the ideal mechanical advantage of the inclined conveyor belt.

7. What force is required to lift each boat using the conveyor belt if friction is ignored?

