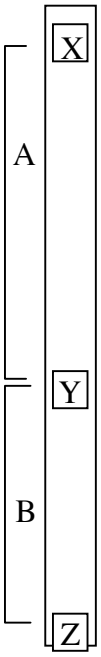
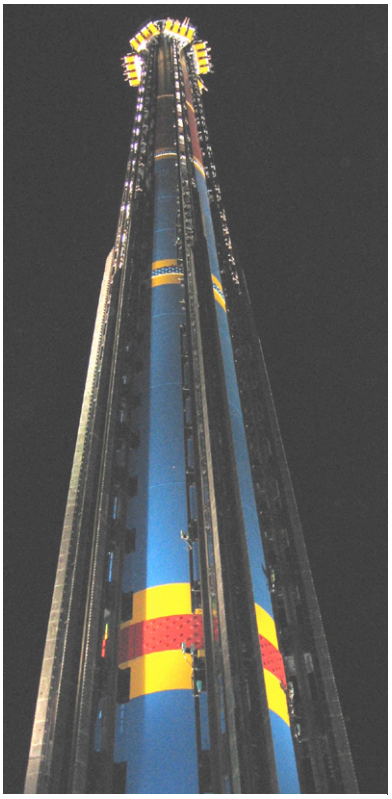
QUALITATIVE QUESTIONS





SUPERMAN
Tower of Power

Observe the motion of the cars as they are pulled to the top of the tower and dropped. The labeled points in the diagram are X at the top, Y at the point braking begins <u>when going down</u>, and Z at the bottom.

1. At which of the following points is the ride's:

   a. speed the greatest? _____

   b. gravitational energy the greatest? ___

   c. gravitational energy the least? _____

   d. kinetic energy the greatest? _____

2. During which lettered section is the ride's:

   a. acceleration the greatest? _____

   b. normal force greater than the gravitational force on a rider? _____

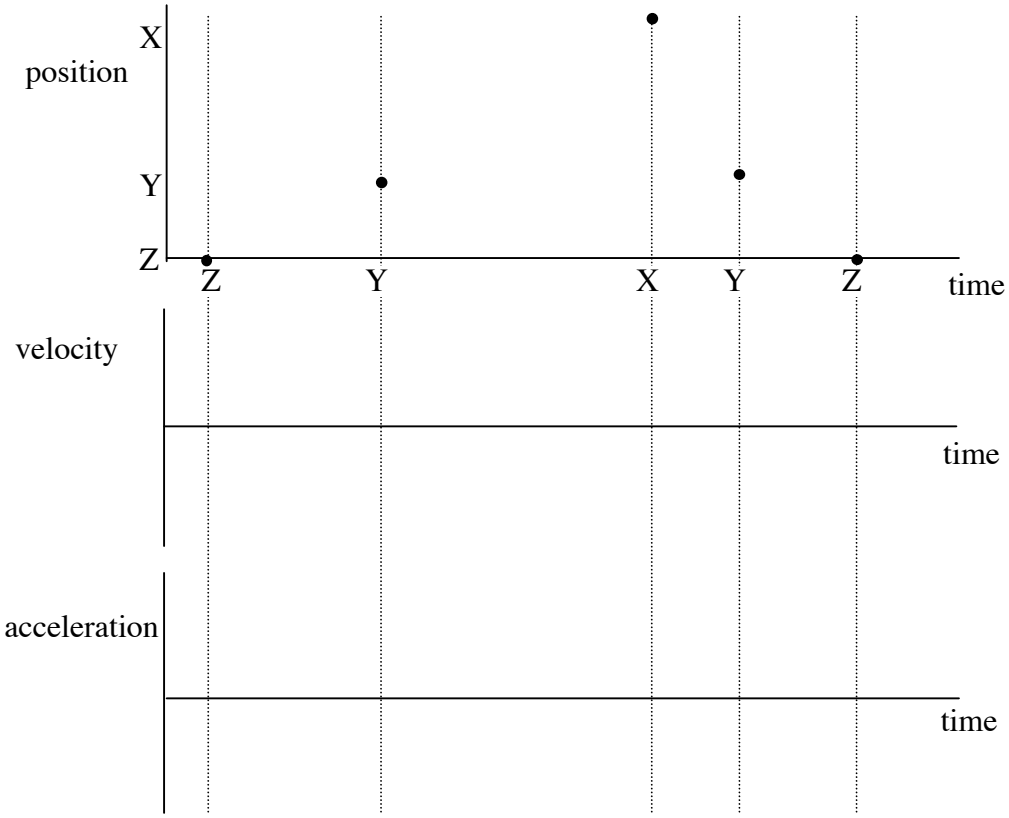
   c. gravitational force greater than the normal force on a rider? _____

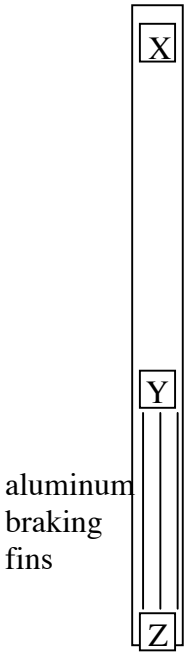
3. A foam ball has been attached to the restraint. Hold the ball in your hand as the car rises. When the ride falls, release the ball in front of you. Describe the behavior of the ball as you fall.

4. The braking system on Superman is passive and requires no friction or input of power. Long aluminum fins are attached to the lower portion of the tower. The back of each car has very strong magnets that straddle the aluminum fins and stop the falling car. How does this passive braking system work?

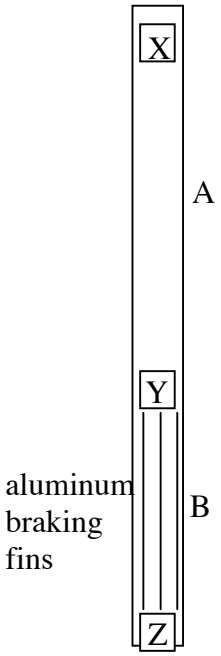
5. Carefully observe the motion of the car on the way up. Does the velocity increase, decrease, or stay the same when the car leaves the aluminum fin region of the tower? What would account for this change?

6. Sketch qualitative position-time, velocity-time, and accleration-time graphs for one complete cycle of the ride. The letters indicate the times the ride reaches the indicated positions. Treat upward as the positive direction.





7. Draw qualitative free body diagrams for a rider at each of the points indicated.



point Z v=0m/s	point B accel. upward	point A const. vel. up	slowing to pt. X	point A falling	point B braking

QUANTITATIVE QUESTIONS

Kinematics Analysis:

1. Use the graph on the next page to find the maximum height the car reaches.

2. Find the height of the car when braking begins. (Use the graph on the following page.)

3. Determine the distance the car falls before braking.

4. With a stopwatch, measure the time the car falls freely before braking.

5. Based on your measurements, calculate the acceleration of the riders while falling.

6. Calculate the velocity of the car at the moment braking begins.

7. With a stopwatch, measure the time from the moment braking begins to the time the car stops at the bottom.

8. Calculate the average acceleration while braking.

9. Is the acceleration while braking uniform? How do you know?