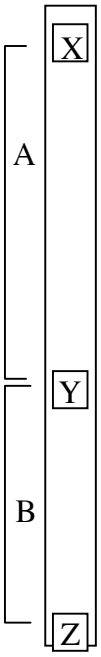
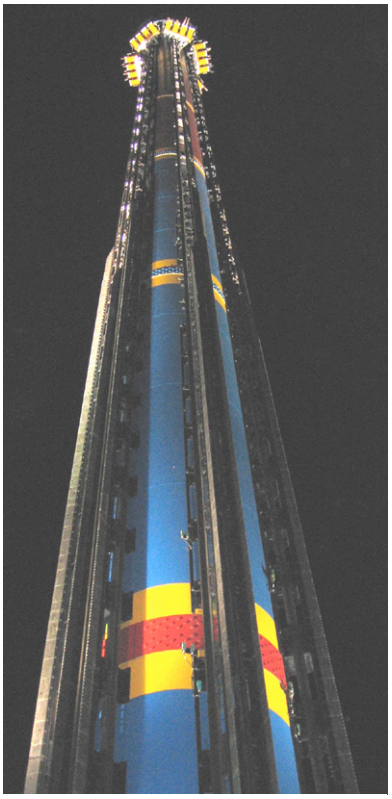
QUALITATIVE QUESTIONS

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 when going down, and Z at the bottom.





SUPERMAN
Tower of Power

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? _____

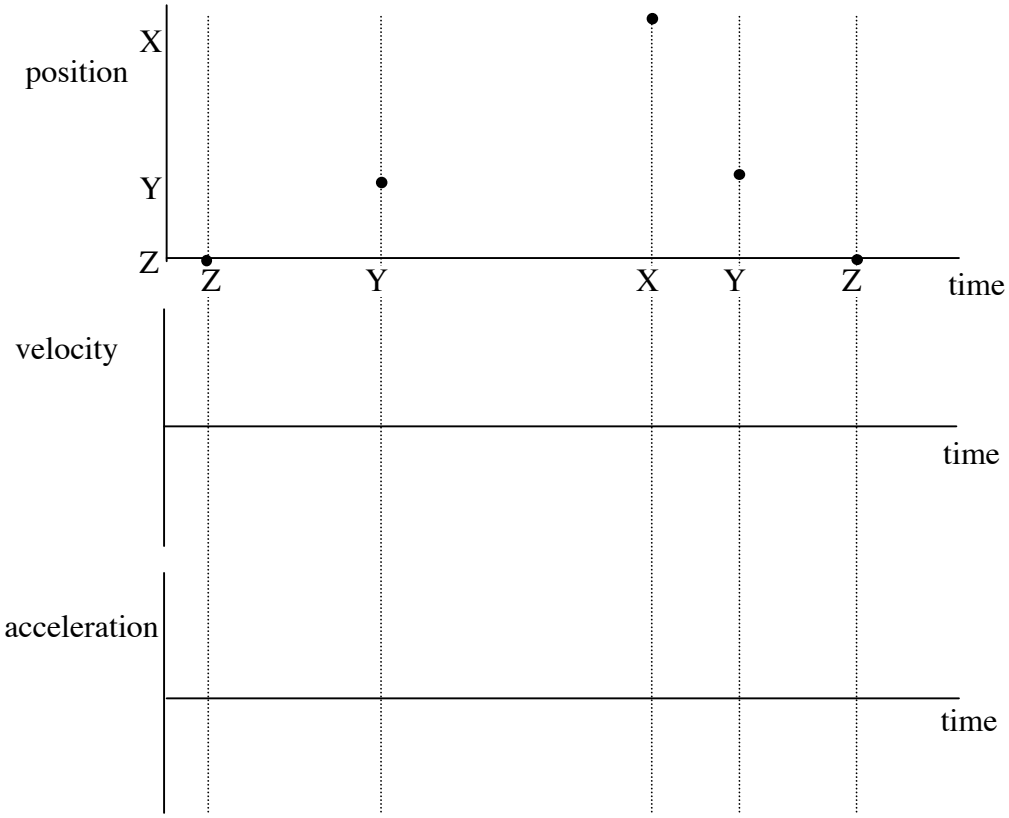
   b. normal force greater than the gravitational force on a rider? _____

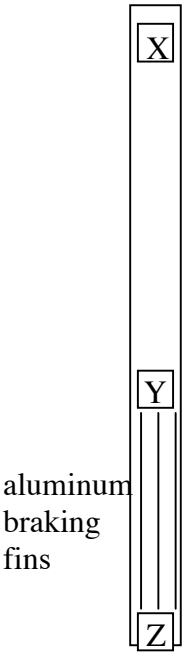
   c. gravitational force greater than the normal force on a rider? _____

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.

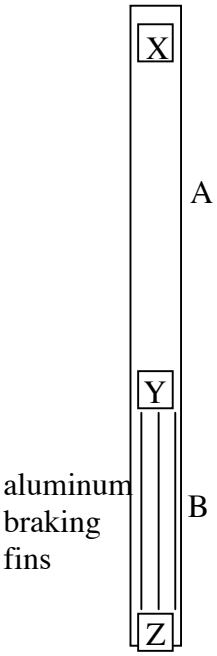
Superman

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 getting faster moving up.	point A constant speed up	getting slower moving up to pt. X	A falling down	point B getting slower moving down

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. Watch the ride, and use a stopwatch to measure the time the car falls freely before braking.

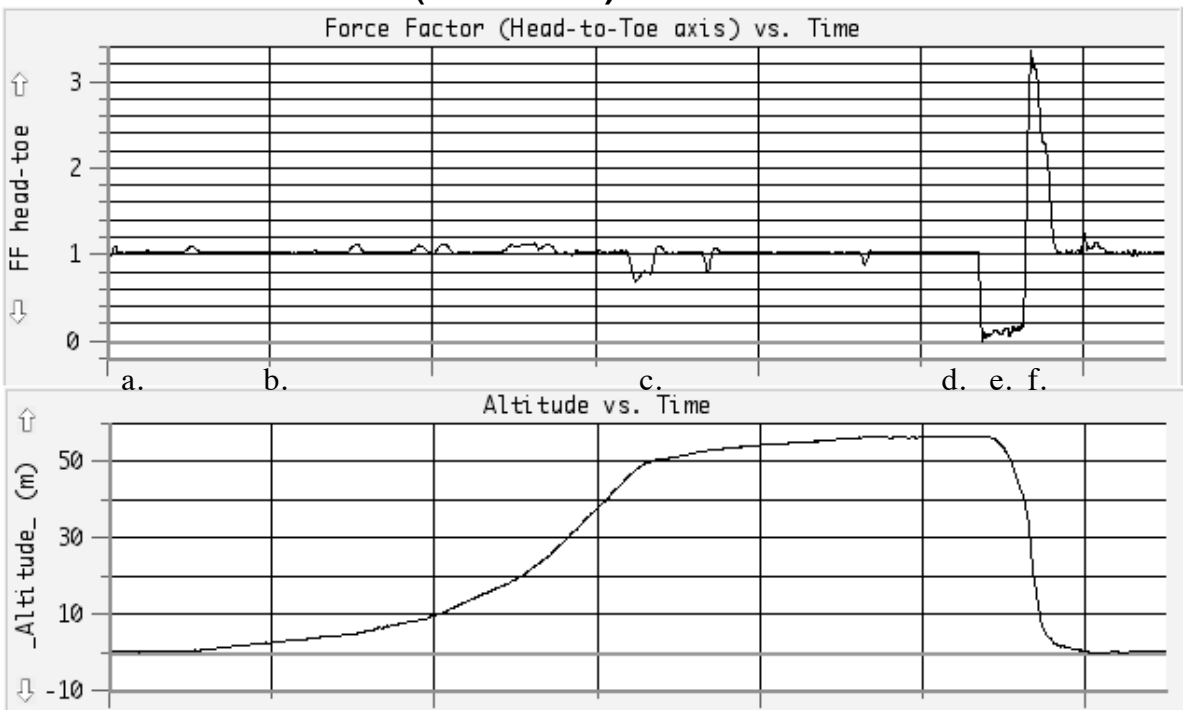
5. Based on your measurements, calculate the acceleration of the riders while falling.

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.

QUANTITATIVE QUESTIONS (continued)



Force Analysis:

Energy Analysis

For the purposes of the questions that follow, let us estimate that the mass of the car carrying four riders is 700 kg.

13. Calculate the gravitational potential energy of the car and riders at the top of the ride relative to the ground.

14. Explain why the energy supplied by the ride to lift the car to the top is greater than the gravitational energy of the car at the top.

15. What is the maximum kinetic energy of the car.

16. Calculate the gravitational energy of the car relative to the ground at the moment braking begins.

17. Use your previous calculations to find the total energy of the car at the top and when braking begins. How should these values compare?

Total Energy at top _____ Total Energy as braking begins _____

18. What ultimately happens to all of the energy of the system?