Upper Merion
Six Flags Great Adventure
Physics Day

photo credit: Mr. Mont

Conceptual Questions & Problems

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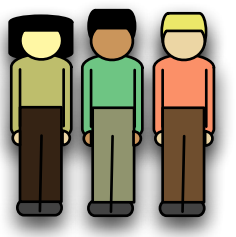
Section 1: General Questions

CQ Of the quantities in kinematics - position, velocity, and acceleration, which one does your body actually feel on a ride? What are the different ways a ride can produce that quantity? What factors can affect how much of it you get on a ride? Give some examples from actual rides.

P Every ride at the amusement park has a ride capacity. The ride capacity is the number of people who can ride each hour. Choose one ride at the park and devise a way of calculating its ride capacity. List the data you used and show the calculation.



P According to Great Adventure's website, you can see Philadelphia from the top of Nitro, 65.5 m high (215 ft). Theoretically, on a spherical Earth with no hills or trees, how far could you see from that height? Make sure to include a diagram and calculations.

https://www.sixflags.com/greatadventure/attractions/nitro

photo credit: GreatAdventureHistory.com

Section 2: Spinning Rides

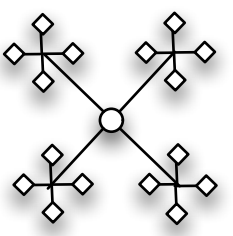
CQ Six Flags claims that the Big Wheel (Ferris Wheel) ride is 150 ft tall. How does its size affect the speed of the riders? How does its size affect the acceleration of the riders?
https://www.sixflags.com/greatadventure/attractions/big-wheel

CQ Why do spinning rides make people feel sick? What is it about the physics and your body that may not mix so well?

CQ You are trying to convince your friend to sit in the best seat while on the SkyScreamer swings ride. Explain which seat she should sit in - the inner or the outer one - and why.
https://www.sixflags.com/greatadventure/attractions/skyscreamer


photo credit: SixFlags.com

CQ On the Deja Vu ride, you are in a group of four cars rotating around a pivot point on the end of an arm that is itself rotating! When viewed from above, what would your actual path look like?
https://www.sixflags.com/greatadventure/attractions/dejavu



CQ On the Swashbuckler ride, you are spun fast enough that you feel as if a centrifugal force pins you to the wall. From a point of view outside the ride, describe what is really happening.
https://www.sixflags.com/greatadventure/attractions/swashbuckler

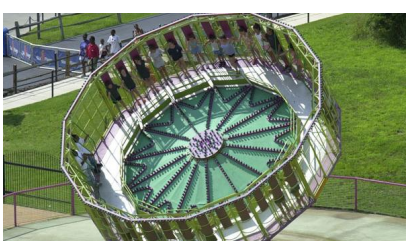


photo credit: SixFlags.com

P According to Great Adventure's website, the SkyScreamer ride hurls you around a 30 m (98 ft) circle and has a maximum speed of 18 m/s (40 mi/hr). First, do you think 30 m is the circumference, diameter or radius of the ride? Second, calculate how many g's a rider would feel at top speed.
https://www.sixflags.com/greatadventure/attractions/skyscreamer
video: http://www.mrmont.com/GrAdv/SkyLoop4.mov


photo credit: Mr. Mont

Section 3: Roller Coasters

CQ Does the maximum height alone make a roller coaster a fast ride? Why or why not?

CQ Download an app on your phone that can display and export your phone's accelerometers readings. Turn it on and place it securely in your pocket while riding a coaster. Obtain an aerial view of the coaster (using either google maps aerial view or maps.bing.com bird's eye view). Connect the different parts of the track to the different parts of the graph of the acceleration data.

CQ Some of the roller coasters in the park are constructed primarily out of wood while others are constructed primarily out of steel. How has the use of these two different materials influenced the designs of the classic wooden roller coaster and the modern steel roller coaster? Give specific examples from actual coasters at the park.

CQ Different environmental factors can affect how a coaster feels and how fast it is on a particular day. Describe the environmental factors that can affect a wooden coaster vs a steel coaster and how they might affect the ride.

photo credit: Mr. Mont

P Choose one of the coasters in the park and calculate its ideal speed at the bottom of the first hill (speed if there were no friction or drag.) List your starting data and show your calculation. Is the ideal speed affected by the mass of the riders?

P According to Great Adventure's website, Nitro drops 65.5 meters (215 ft) on the first hill and attains speeds of 35.8 m/s (80 mi/hr). Based on that information, figure out a way to calculate whether friction and drag affect the top speed of the ride a lot or very little.

https://www.sixflags.com/greatadventure/attractions/nitro

photo credit: wikimedia commons

P According to Great Adventure's website, King Da Ka accelerates you from 0 to 57 m/s (0 to 128 mi/hr) in 3.5 s. How big is that acceleration? How many g's is that? How far did you travel during that acceleration?

https://www.sixflags.com/greatadventure/attractions/kingda-ka

photo credit: Mr. Mont

Section 4: Drop Rides

CQ If there were a Roller Coaster and a free-fall ride (a ride that drops you straight down) that had the same height drop and had no drag or friction, which one would get you to the bottom of the drop in the shortest time? Which one would give you the greatest speed at the bottom? Be sure to explain your answers or calculate rough numbers to prove your point.

CQ Why would a true free fall ride be very dangerous? What kinds of forces are designed into rides that drop you straight down so that they are not dangerous?

P According to Great Adventure's website, the Parachute Training Center ride drops you 76 m (250 ft) How long would it take to drop that height in free fall? What would be the speed just before impact? Estimate the actual average speed from the video linked below.

https://www.sixflags.com/greatadventure/attractions/parachute-training-center-edwards-afb

video: http://www.mrmont.com/GrAdv/ParaDrop.mov

photo credit: GreatAdventureHistory.com

P There is a new ride called Zumanjaro Drop of Doom coming to Great Adventure this spring; hopefully it will be open when we get there. According to Great Adventure's website you will drop 126 m (415 ft) in 10 s, reaching a speed of 40 m/s (90 mi/hr). From this data, how many things can you calculate about this ride?

https://www.sixflags.com/greatadventure/attractions/zumanjaro-drop-doom

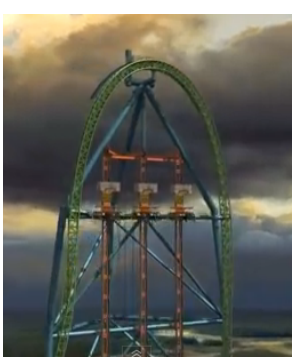


photo credit: SixFlags.com

Section 5 Back & Forth Swing Rides

CQ Of the following factors, which might affect the time it takes the Dare Devil Dive to swing back and forth: length of the cables, mass of the riders, or drag forces on the riders? Of the things that do affect the time, explain how each one could have to be changed to make the time longer.

https://www.sixflags.com/greatadventure/attractions/dare-devil-dive

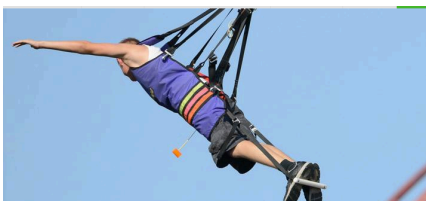


photo credit: SixFlags.com

CQ How would you determine whether The Buccaneer ride is in Simple Harmonic Motion? What data would you collect?

http://www.greatadventurehistory.com/Buccaneer.htm

photo credit: GreatAdventureHistory.com

P Take a look at the video of the Dare Devil Dive linked below. Estimate the period of the motion and use it to calculate the effective length of the cable that suspends the riders. What are some factors about the motion that might make your calculation inaccurate?

https://www.sixflags.com/greatadventure/attractions/dare-devil-dive

video: http://www.mrmont.com/GrAdv/BigSwing.mov

photo credit: Mr. Mont

P According to Great Adventure's website, the Dare Devil Dive reaches speeds of 26.8 m/s (60 mi/hr). Use that figure to estimate the height of the drop if there were no drag. Would that number be affected by the mass of the riders?

https://www.sixflags.com/greatadventure/attractions/dare-devil-dive

Links

https://www.sixflags.com/greatadventure

The official Six Flags Great Adventure site.

http://www.greatadventurehistory.com

Amazing site detailing all of the rides there are and have ever been at the park. Fascinating photos of many rides being constructed as well as useful ride data. Special thanks to Harry and Tom for permission to use their photos.

http://rcdb.com

The roller coaster database. A great source of data on roller coasters around the world.