Answer to Question #68966, Physics / Mechanics | Relativity

Question: I'm going to Adventureland this summer in Altoona, IA. Adventureland has a wooden roller coaster called the Tornado. Wikipedia says that the Tornado has a height of 28 m and a speed of 93 km/h. Let's assume this is the largest drop and the fastest speed during the ride. a) Assuming no friction how fast would the cart be going at the bottom if the first drop was 28 m? b) Assuming no friction how high would the first drop need to be to have a velocity at the bottom of 93 km/h? c) Could both these measurements, height of 28 m and speed of 93 km/h, be correct? Explain why or why not.

Solution: a) Considering the free fall without friction we can write

$$\frac{mv^2}{2} = mgh$$

$$v = \sqrt{2gh} = 23.44\frac{m}{s} = 84.38\frac{km}{h}$$

b) in the same way

$$h = \frac{v^2}{2g}$$

where $v = 93\frac{km}{h} = 25.83\frac{m}{s}$

so

$$h = \frac{v^2}{2g} = 34\ m$$

c) In fact this two measurements can be correct if the cart has initial speed before the main drop. The speed of $93\frac{km}{h} - 84.38\frac{km}{h} = 8.62\frac{km}{h}$ is comparable to that of a running human being.