Full throttle

All work must be shown. No work will result in no credit

1. Mr. Vining and Mr. Hill were on a reconnaissance trip to Six Flags Magic Mountain one summer to write new labs and engaging (tortuous) activities. Before entering the park, they wanted to practice doing the double triangulation method for calculating height, so they took out their string and protractor in the parking lot to measure the height of X2. While standing at some distance away from X2, Mr. Vining (who stands 1.8 m tall) sighted to the top of the first hill, and Mr. Hill read an angle of 20.0°. They then moved 30.0 meters **closer**, and sighted an angle of 24° to the top of the first hill. What is the height of the first hill of X2?

Height = \_\_\_\_\_\_\_\_\_\_

2. They walked over to Full Throttle, the newest roller coaster at Magic Mountain. After observing the coaster for a while, they began to wonder what the speed of the train was when it is at the top of the highest hill, just before the train returns to the station. Mr. Hill ran up to the station to measure the train, (and ride the ride) and got a value of 12.0 meters. Mr. Vining, while sitting on the bench with a stop watch (he’s nearing retirement after all), measured that the train took 4.2 seconds to pass the highest point on the hill. What was the speed of the train at the top of the hill?

Speed = \_\_\_\_\_\_\_\_\_\_

3. On Full Throttle, the train is accelerated out of the station with powerful electromagnets. The train goes from rest to 30.0 m/s in 0.750 seconds. What was the acceleration during this time?

Acceleration = \_\_\_\_\_\_\_\_\_\_

a) How many g’s would a rider on the train experience during this time?

(1 g = 10.0 m/s/s)

g”s = \_\_\_\_\_\_\_\_\_\_

3. Next, Mr. Vining and Mr. Hill walked over to Superman: Escape from Krypton. They used Mr. Vining’s radar gun and clocked the car to be traveling at 40.0 m/s just before reaching the vertical tower. They estimated the mass of the full car to be 750. kg

a) What was the kinetic energy just before reaching the vertical tower?

Kinetic energy = \_\_\_\_\_\_\_\_\_\_

b) Using conservation of energy, determine the maximum height that the car will reach before falling back down.

Height = \_\_\_\_\_\_\_\_\_\_\_\_\_

4. Next, Mr. Vining and Mr. Hill walked to the entrance of Lex Luthor’s Drop of Doom. They noticed that riders were lifted to a height of 125 meters above the ground in 90.0 seconds. The mass of the full cart is 1510 kg. How much power is expended each time a full cart is lifted.

Power = \_\_\_\_\_\_\_\_\_\_

5. After so many thrilling experiences, they decided it was time to go on the ULTIMATE thrill ride: The carrousel…They measured the radius of the carrousel to be 12.5 meters as measured to the outer horse, where the rider experiences the greatest thrills, highest velocities, and greatest centripetal forces. They measure the time an outer horse takes to complete 5.00 rotations to be 127.5 seconds. What is the tangential velocity of the outer horse?

Velocity = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_