Answer on Question#38822, Programming, C++

The fast train known as the TGV atlantique (TRAIN GRANDE VITESSE) that runs south from paris to le mans in france has a top speed of 310 km/h. (a)if the train goes around a curve at this speed and the acceleration experienced by the passengers is to be limited to 0.05g, what is the smallest radius of curvature for the track that can be tolerated? (b) if there is a curve with a 0.94-km radius , to what speed must the train be slowed?

Solution:

a) Centripetal acceleration is part of moving in a circular path. Centripetal acceleration points toward the center of the circular path of the train, but is felt by passengers as a force pushing them to the outer edge of the circular path.
The equation for centripetal acceleration is:
$$a_r = \frac{v^2}{r}.$$
Where a_r is centripetal acceleration, v is velocity in meters per second, and r is the radius of the circle in meters.

$$v = 310 \ \frac{km}{h} = 310 \cdot \frac{1000}{3600} = 86.11 \ \frac{m}{s};$$
$$a = 0.05g = 0.05 \cdot 9.8 \ m/s^2 = 0.49 \ m/s^2.$$

The smallest radius of curvature for the track:
$$r = \frac{v^2}{a_r} = \frac{86.1^2}{0.49} = 15129 \ m = 15.129 \ km \approx 15.13 \ km.$$

b)
$$r = 0.94 \ km = 940 \ m;$$
$$a = 0.05g = 0.05 \cdot 9.8 \ m/s^2 = 0.49 \ m/s^2.$$
$$v = \sqrt{a_r r} = \sqrt{0.49 \cdot 940} = \sqrt{460.6} = 21.46 \ m/s = 21.46 \cdot 3.6 \ km/h = 77.26 \ km/h \ .$$

Answer: a) r=15.13 km; b) v=77.26 km/h .