

Answer on Question 49037, Physics, Mechanics | Kinematics | Dynamics

Question:

One of the world's largest Ferris wheels, the Cosmo Clock 21 with a radius of 50.0 m is located in Yokohama City, Japan. Each of the sixty gondolas on the wheel takes 1.00 minute to complete one revolution when it is running at full speed. Note: Ignore gravitational effects. What is the centripetal acceleration of the gondola when the Ferris wheel is running at full speed?

Solution:

For the case of circular motion the formula for the centripetal acceleration looks like:

$$a = \omega^2 r,$$

where a is the centripetal acceleration, ω is the angular velocity and r is the radius. We know the gondola's frequency of rotation – 1rpm. So, in order to find the angular velocity we need to convert revolution per minute to revolution per second and use the formula:

$$\omega = 2\pi f = 2\pi \cdot 0.01666\text{rps} = 0.1047 \frac{\text{rad}}{\text{s}}.$$

Therefore, substituting angular velocity to the first formula we can obtain centripetal acceleration:

$$a = \left(0.1047 \frac{\text{rad}}{\text{s}} \right)^2 \cdot 50\text{m} = 0.548 \frac{\text{m}}{\text{s}^2}.$$

Answer:

$$a = 0.548 \frac{\text{m}}{\text{s}^2}.$$

