How many revolutions per minute would a 26m -diameter Ferris wheel need to make for the passengers to feel "weightless" at the topmost point?

Solution:

$D = 26m - diameter\ of\ the\ wheel;$

$\mathrm{F_c} - centrifugal\ force;$

$V - velocity$ at the topmost point;

Newton's second law for passengers at the topmost point ("weightless" means that the resultant of all forces is zero)

$$\overrightarrow{\mathrm{mg}} + \overrightarrow{\mathrm{F_c}} = \vec{0}$$

$$\mathrm{y}: -\mathrm{mg} + \mathrm{F_c} = 0$$

$$\mathrm{F_c} = \mathrm{mg} \qquad (1)$$

Formula of the centrifugal force (D = 2R):

$$\mathrm{F_c} = \mathrm{m}\frac{\mathrm{V}^2}{\mathrm{R}} = \frac{2\mathrm{mV}^2}{\mathrm{D}} \qquad (2)$$

(2)in(1):

$$\frac{2\mathrm{mV}^2}{\mathrm{D}} = \mathrm{mg}$$

$$2\mathrm{mV}^2 = \mathrm{Dmg}$$

$$\mathrm{V} = \sqrt{\frac{\mathrm{Dg}}{2}}$$

Formula for the frequency:

$$\nu = \frac{1}{\mathrm{T}} = \frac{1}{\frac{2\pi\mathrm{R}}{\mathrm{V}}} = \frac{\mathrm{V}}{2\pi\mathrm{R}} = \frac{\mathrm{V}}{\pi\mathrm{D}} \qquad (3)$$

(2)in(3):

$$\nu = \sqrt{\frac{\mathrm{Dg}}{2}} \cdot \frac{1}{\pi\mathrm{D}} = \sqrt{\frac{\mathrm{g}}{2\pi\mathrm{D}}} = \sqrt{\frac{9.8\frac{\mathrm{m}}{\mathrm{s}^2}}{2\pi \cdot 26\mathrm{m}}} = 0.245\ \frac{\mathrm{revolutions}}{\mathrm{sec}} = 14.7\frac{\mathrm{revolutions}}{\mathrm{min}}$$

Answer: Ferris wheel need to make $14.7\frac{\mathrm{revolutions}}{\mathrm{min}}$ for the passengers to feel "weightless" at the topmost point.