Answer on Question#54838 - Physics - Mechanics - Kinematics - Dynamics

a) At what angular speed must a centrifuge rotate if a particle placed 7.0 cm from its axis of rotation is to experience an acceleration of 1000g? (Take $g = 10\ \mathrm{ms}^{-2}$)
b) Explain why hurricanes spin counter clockwise in the Northern hemisphere and clockwise in the Southern hemisphere.

Solution:

a) The centrifugal acceleration is given by

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

where ω – is the angular speed, and r – is the distance to the axis of rotation. Since it is given that $a = 1000g$, we obtain

$$\omega = \sqrt{\frac{a}{r}} = \sqrt{\frac{1000g}{r}} = \sqrt{\frac{1000 \cdot 10\,\frac{\mathrm{m}}{\mathrm{s}^2}}{0.07\mathrm{m}}} = 378\,\frac{\mathrm{rad}}{\mathrm{s}}$$

b) The Coriolis force is part of the reason that hurricanes in the Northern Hemisphere rotate counterclockwise and clockwise in the Southern hemisphere. If the Earth didn't spin, we would have wicked 300 mph winds from the tropics to the poles and back again. The Earth does spin however, and in the mid-latitudes, the Coriolis force causes the wind—and other things—to veer to the right in the Northern Hemisphere and to the left in the Southern hemisphere. So when a low pressure center forms north of the equator, winds are pulled to the right as they blow into the center of the low and the wind flow is counter-clockwise. South of the equator, winds toward the low's center are deflected to the left, so the rotation is clockwise.

Answer:

a) $378\,\frac{\mathrm{rad}}{\mathrm{s}}$