## Answer on Question #56695-Physics-Other

(a) What is the tangential acceleration of a bug on the rim of a 7.0 in. diameter disk if the disk moves from rest to an angular speed of 75 rev/min in 3.0 s?

(b) When the disk is at its final speed, what is the tangential velocity of the bug?

(c) One second after the bug starts from rest, what is its tangential acceleration?

What is its centripetal acceleration?

What is its total acceleration?

## Solution

(a) The tangential acceleration of a bug on the rim is

$$a_{\tau} = r \frac{d\omega}{dt} = 3.5 \text{ in} \frac{m}{39.37 \text{ in}} \frac{75 \frac{\text{rev}}{\text{min}} \left(\frac{2\pi \text{ rad}}{\text{rev}}\right) \left(\frac{1 \text{ min}}{60 \text{ s}}\right)}{3.0 \text{ s}} = 0.23 \frac{m}{\text{s}^2}.$$

(b) The tangential velocity of the bug is

$$v = \omega r = 75 \frac{\text{rev}}{\min} \left(\frac{2\pi \, rad}{rev}\right) \left(\frac{1 \, \min}{60s}\right) 3.5 \, \text{in} \, \frac{m}{39.37 \, \text{in}} = 0.70 \, \frac{m}{s}.$$

(c) The tangential acceleration of a bug on the rim is the same as in (a).

$$a_{\tau} = 0.23 \frac{m}{s^2}.$$

The centripetal acceleration is

$$a_{c} = r\omega^{2} = r\left(t\frac{d\omega}{dt}\right)^{2} = 3.5 \text{ in} \frac{m}{39.37 \text{ in}} \left(1s\frac{75\frac{\text{rev}}{\min}\left(\frac{2\pi \text{ rad}}{rev}\right)\left(\frac{1}{60s}\right)}{3.0 \text{ s}}\right)^{2} = 0.61\frac{m}{s^{2}}$$

The total acceleration is

$$a = \sqrt{a_{\tau}^2 + a_c^2} = \sqrt{0.23^2 + 0.61^2} = 0.65 \frac{m}{s^2}$$

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