Answer on Question #41002, Physics, Mechanics

Starting from rest, Ali goes around a circular path (of 100 m diameter) with a constant angular acceleration α. If he completed 4 rounds every 3 min, what is his angular displacement, and angular acceleration and final angular speed?

More information is needed

8, 0.56 rad/sec^2, 101 rad/sec

800, 0.078 rad/sec, 12.4 rad/sec^2

8 , 0.003 rad/sec^2, 0.56 rad/sec

800, 0.078 rad/sec^2, 12.4 rad/sec

Solution:

Given:

$d = 100$ m, radius is $r = 50$ m,

$t = 3$ min $= 180$ s,

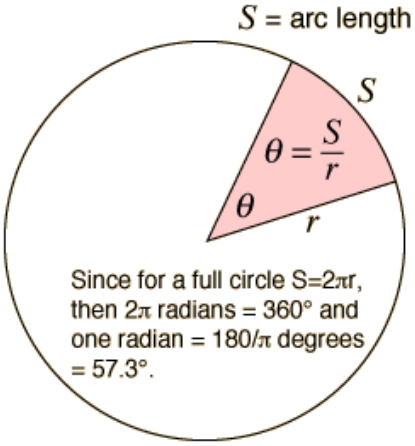
Time for one round is $t_1 = \frac{180}{4}\text{s} = 45$ s,

$\omega_0 = 0$

$\theta = ?$,

$\alpha = ?$,

$\omega = ?$



The angular displacement is defined by:

$$\theta = \frac{S}{r} = \frac{4 \cdot 2\pi r}{r} = 8\pi = 25.12 \text{ rad}$$

Equations for constant angular acceleration

$$\theta = \overline{\omega} t, \quad \overline{\omega} = \frac{\omega_0 + \omega}{2} = \frac{0 + \omega}{2} = \frac{\omega}{2}$$

$$\omega^2 = {\omega_0}^2 + 2\alpha\theta$$

Thus, the final angular speed is

$$\omega = \frac{2\theta}{t} = \frac{2 \cdot 25.12}{180} = 0.28 \text{ rad/s}$$

$$\theta = \omega_0 t + \frac{1}{2}\alpha t^2$$

The angular acceleration is

$$\alpha = \frac{\omega^2}{2\theta} = \frac{0.28^2}{2 \cdot 25.12} = 0.00156 \text{ rad/s}^2$$

Answer. More information is needed.

The angular displacement is $\theta = 25.12$ rad;
the angular acceleration is $\alpha = 0.00156 \text{ rad/s}^2$;
the final angular speed is $\omega = 0.28$ rad/s.