Answer on Question 68151, Physics, Other

Question:

A disc is rotated from rest about its vertical axis through its centre, O. The angular acceleration is 2.50 rad/s^2. After 4.0 s, calculate the angular velocity and the angular displacement.

Solution:

a) We can find the angular velocity of the disc after $t = 4.0\,s$ from the kinematic equation:

$$\omega = \omega_i + \alpha t,$$

here, ω_i is the initial angular velocity of the disc at $t = 0$ (since the disc starts from rest it will be equal to zero), ω is the final angular velocity of the disc after $t = 4.0\,s$, α is the angular acceleration and t is the time.

Then, we can calculate the angular velocity of the disc after $t = 4.0\,s$:

$$\omega = \omega_i + \alpha t = 0\ \frac{rad}{s} + 2.50\ \frac{rad}{s^2} \cdot 4.0\,s = 10\ \frac{rad}{s}.$$

b) We can find the angular displacement from the kinematic equation:

$$\omega^2 = \omega_i^2 + 2\alpha\Delta\theta,$$

here, ω_i is the initial angular velocity of the disc at $t = 0$ (since the disc starts from rest it will be equal to zero), ω is the final angular velocity of the disc after $t = 4.0\,s$, α is the angular acceleration and $\Delta\theta$ is the angular displacement.

Then, we get:

$$\omega^2 = 2\alpha\Delta\theta,$$

$$\Delta\theta = \frac{\omega^2}{2\alpha} = \frac{\left(10\ \frac{rad}{s}\right)^2}{2 \cdot 2.50\ \frac{rad}{s^2}} = 20\,rad.$$

Answer: a) $\omega = 10\ \frac{rad}{s}$. b) $\Delta\theta = 20\,rad$.