Answer on Question 49077, Physics, Mechanics | Kinematics | Dynamics

Question:

1. A turntable is initially rotating at 1.50 rad/s and accelerates at 2.50 rad/s for 5.0s.
a) Calculate the final angular velocity in rad/s
b) Compute the angular displacement during the 5.0 s in radians and revolutions

Solution:

a) By the definition of the angular acceleration we have:

$$\alpha = \frac{\Delta\omega}{\Delta t} = \frac{\left(\omega_f - \omega_i\right)}{t},$$

where ω_i is the initial angular velocity, ω_f is the final angular velocity and t is the time. So, from the formula for angular acceleration we can find the final angular velocity:

$$\omega_f = \omega_i + \alpha t = 1.50\frac{rad}{s} + 2.50\frac{rad}{s^2}\cdot 5.0s = 14\frac{rad}{s}.$$

b) By the definition of the angular displacement we have:

$$\theta = \frac{1}{2}\alpha t^2 + \omega_i t = 0.5\cdot 2.50\frac{rad}{s^2}\cdot\left(5.0s\right)^2 + 1.50\frac{rad}{s}\cdot 5.0s = 38.75rad = \frac{38.75rad}{2\pi} = 6.2rev.$$

Answer:

a) The final angular velocity is $\omega_f = 14\frac{rad}{s}$.

b) The angular displacement is $\theta = 38.75rad$ or $\theta = 6.2rev.$