

87. The motion consists of two stages. The first, the interval $0 \leq t \leq 20$ s, consists of constant angular acceleration given by

$$\alpha = \frac{5.0 \text{ rad/s}}{2.0 \text{ s}} = 2.5 \text{ rad/s}^2 .$$

The second stage, $20 < t \leq 40$ s, consists of constant angular velocity $\omega = \Delta\theta/\Delta t$. Analyzing the first stage, we find

$$\begin{aligned}\theta_1 &= \left. \frac{1}{2} \alpha t^2 \right|_{t=20} = 500 \text{ rad} \\ \omega &= \left. \alpha t \right|_{t=20} = 50 \text{ rad/s} .\end{aligned}$$

Analyzing the second stage, we obtain

$$\theta_2 = \theta_1 + \omega \Delta t = 500 + (50)(20) = 1500 \text{ rad} .$$