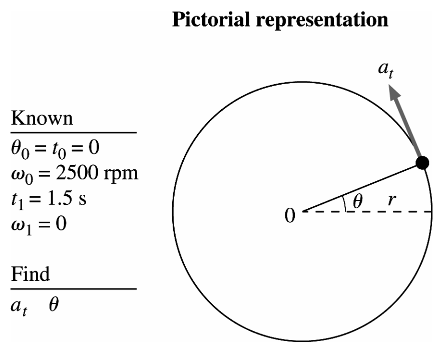
4.36. Model: Model the particle on the crankshaft as being in nonuniform circular motion.
Visualize:



Solve: **(a)** The initial angular velocity is $\omega_0 = 2500 \text{ rpm} \times (1 \text{ min}/60 \text{ s}) \times (2\pi \text{ rad/rev}) = 261.8 \text{ rad/s}$. The crankshaft slows from 261.8 rad/s to 0 in 1.5 s. Thus

$$\omega_1 = 0 = \omega_0 + \frac{a_t}{r} t_1 \Rightarrow a_t = -\frac{r\omega_0}{t_1} = -\frac{(0.015 \text{ m})(261.8 \text{ rad/s})}{1.5 \text{ s}} = -2.618 \text{ m/s}^2 = -2.6 \text{ m/s}^2$$

(b) During these 1.5 s, the crankshaft turns through angle

$$\theta_1 = \theta_0 + \omega_0 t_1 + \frac{a_t}{2r} t_1^2 = 0 + (261.8 \text{ rad/s})(1.5 \text{ s}) - \frac{2.618 \text{ m/s}^2}{2(0.015 \text{ m})}(1.5 \text{ s})^2 = 196 \text{ rad}$$

In terms of revolutions, $\theta_1 = (196 \text{ rad})(1 \text{ rev}/\pi \text{rad}) = 31.2 \text{ rev}$.