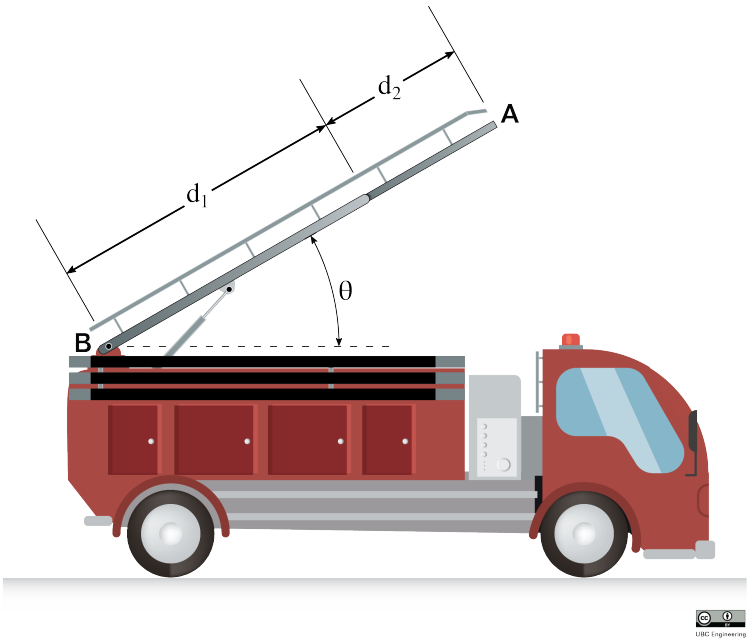
22-R-KM-TW-2



A fire truck is rescuing a person from a burning building. It needs to deploy the ladder to a height of $h = 10\ m$ above the ground. The height of the fire truck (from the ground to point B) is $4\ m$. The ladder starts initially from rest with $\theta = 0°$ and accelerates with a constant angular acceleration of $\alpha = 0.01\ rad/s^2$. If the combined length of d_1 and d_2 is $8\ m$, how long will it take for the ladder to reach the person at height h?

Solution:

$$\sin\theta = \frac{h - h_{truck}}{L}$$

$$\theta = \arcsin\left(\frac{h - h_{truck}}{L}\right) = \arcsin\left(\frac{10-4}{8}\right) \approx 0.848\ rad$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$$

$$\theta_0 = \omega_0 = 0$$

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

$$t = \sqrt{\frac{2\theta}{\alpha}} = \sqrt{\frac{2(0.848)}{0.01}} = 13.0\ s$$