An antique spring-driven Victrola phonograph plays recordings at 78 rpm. At the end of each record the arm hits a lever that activates a brake. How many radians does the record turn if it is brought to rest in 1.0 s?

$$\omega_0 = 78 \frac{\text{rev}}{\text{min}} \left(\frac{2\pi \text{ rad}}{1 \text{ rev}}\right)\left(\frac{1 \text{ min}}{60 \text{ s}}\right) = 8.168 \text{ rad/s}$$

$$\omega = 0 \frac{\text{rad}}{\text{s}}$$

$$t = 1.0 \text{ s}$$

$$\Delta\theta = ?$$

$$\Delta\theta = \omega_0 t + \tfrac{1}{2}\alpha t^2$$

$$\omega = \omega_0 + \alpha t$$

$$\alpha = \frac{\omega - \omega_0}{t} = \frac{0 - 8.168\ \text{rad/s}}{1.0\ \text{s}}$$

$$= -8.168\ \text{rad/s}^2$$

$$\Delta\theta = 8.168\ \text{rad/s}\,(1\ \text{s}) + \tfrac{1}{2}\left(-8.168\ \text{rad/s}^2\right)(1\ \text{s})^2$$

$$= 4.084\ \text{rad}$$

$$\boxed{4.1\ \text{rad}}$$