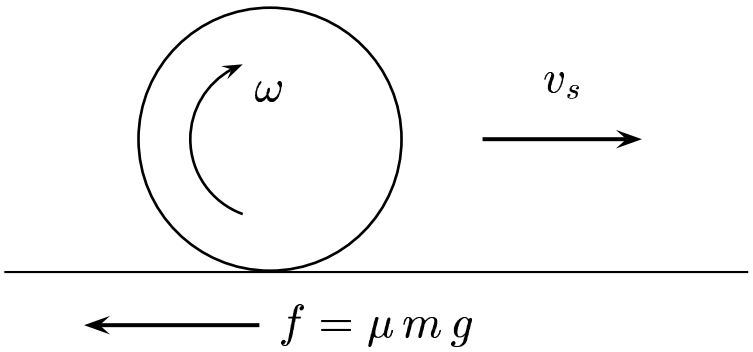
A bowling ball has a mass m, a radius r, and a coefficient of kinetic friction μ. At $t = 0$, $\omega = 0$, $v_s = v_0$.



Find the translational deceleration, a_s, where $v_s(t) = v_0 - a_s t$, and tangential acceleration, $a_\theta = \alpha r$; such that, $v_\theta(t) = \omega r = a_\theta t$.

A) $a_s = g$ and $a_\theta = \dfrac{f r}{I}$.

B) $a_s = g$ and $a_\theta = \dfrac{f r^2}{I}$.

C) $a_s = \mu g$ and $a_\theta = \dfrac{f r}{I}$.

D) $a_s = \mu g$ and $a_\theta = \dfrac{f r^2}{I}$.

Translational deceleration

$$f = m\,a\,, \quad a_s = \frac{f}{m} = \frac{\mu\ m\,g}{m} = \mu\,g\,.$$

Tangential acceleration

$$\tau = f\,r = I\,\alpha\,, \quad a_\theta = \alpha\,r = \frac{f\,r^2}{I} = \frac{\mu\,m\,g\,r^2}{\frac{2}{5}\,m\,r^2} = \frac{5}{2}\,\mu\,g\,.$$

Answer **D**.

11.01-02˙A˙Bowling˙Ball 2004-3-24