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

\[
\begin{array}{c}
\omega \\
v_s
\end{array}
\]

\[
f = \mu m g
\]

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 \( a_\theta = \frac{fr}{I} \).

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

C) \( a_s = \mu g \) and \( a_\theta = \frac{fr}{I} \).

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

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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.

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