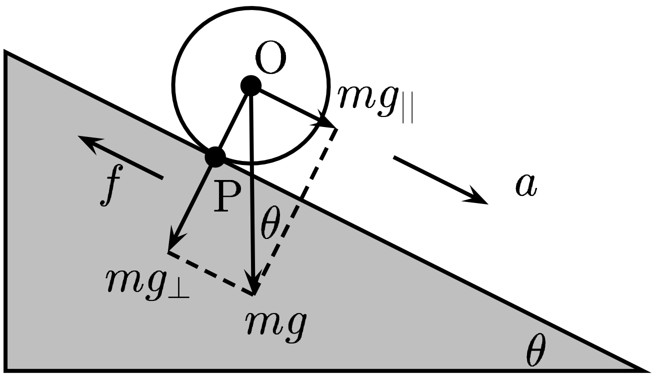
Consider a ball of mass m with its moment of inertia $I_{cm} = I_O = k\,m\,R^2$ rolling down an incline. The angle between the incline and the horizontal direction is θ .



$I_{cm} = k\,m\,R^2$

The equation of motion along the incline, "$\tau = I\,\alpha$", is given by

A) $\tau = m\,g_{\|}\,R = k\,m\,R^2\,\alpha\,.$

B) $\tau = m\,g_{\|}\,R = (\,1 + k\,)\,m\,R^2\,\alpha\,.$

C) $\tau = m\,g\,R = k\,m\,R^2\,\alpha\,.$

D) $\tau = m\,g\,R = (\,1 + k\,)\,m\,R^2\,\alpha\,.$

By inspection, the torque about P is $\tau = m\, g_{\|}\, R$, and the moment of inertia of the ball about P is $(\,1 + k\,)\, m\, R^2$.

So equation of motion now reads

$$\tau = m\, g_{\|}\, R = I_P\, \alpha = (\,1 + k\,)\, m\, R^2\, \alpha = (\,1 + k\,)\, m\, R\, a\,.$$

This gives $a = \dfrac{g\ \sin\theta}{1 + k}$.

Answer **B**.