2022A F=ma Exam: Problem 5

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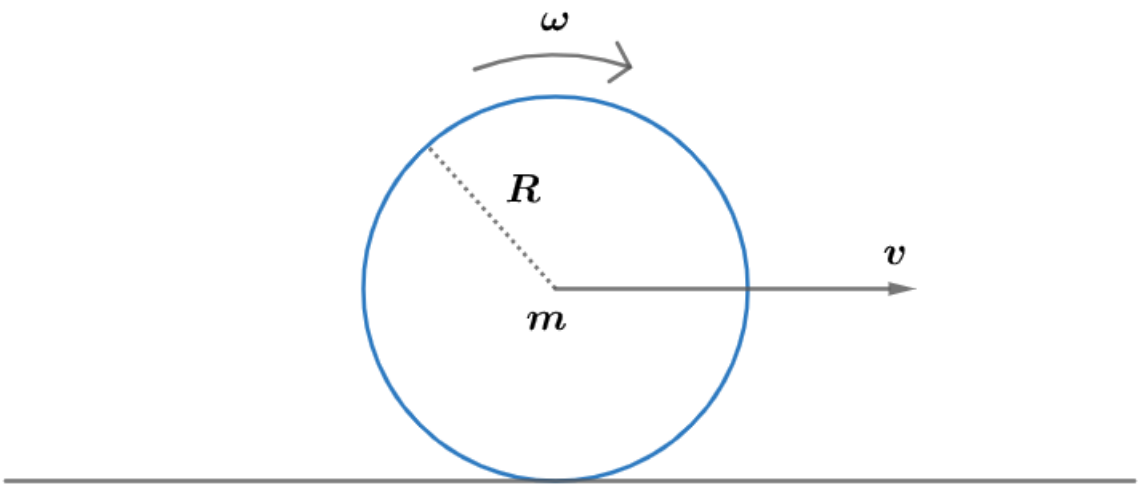

The total kinetic energy is the sum of the translational and rotational kinetic energies:

$$K = K_{\text{trans}} + K_{\text{rot}} = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

For a solid ball, $I = \frac{2}{5}mR^2$. Since the ball is rolling without slipping, we have $\omega = v/R$:

$$\begin{aligned} K &= \frac{1}{2}mv^2 + \frac{1}{2}\left(\frac{2}{5}mR^2\right)\left(\frac{v}{R}\right)^2 \\ &= \frac{1}{2}mv^2\left(1 + \frac{2}{5}\right) = \frac{7}{10}mv^2 \\ &= 0.7\,\text{J} \end{aligned}$$

so the answer is $\boxed{\text{C}}$.