Two masses, $m_1$ and $m_2$, are initially at a radius of $\frac{R}{2}$. They are rotating about the axis $AA'$ with an angular velocity $\omega_i$.

Then they are released to a radius of $R$.

Determine their new angular velocity, $\omega_f$, after release. Assume the process is releasing $m_1$ and $m_2$ does not lead to a change in the angular momentum.

A) $\omega_f = 4\omega_i$.
B) $\omega_f = 2\omega_i$.
C) $\omega_f = \frac{\omega_i}{2}$.
D) $\omega_f = \frac{\omega_i}{4}$.

Conservation of angular momentum give, $I_i \omega_i = I_f \omega_f$, so $\omega_f = \frac{I_i}{I_f} \omega_i$.

But “$I = \sum m r^2$”. When $r$ is doubled, $I$ is increasing by a factor of 4.

This leads to $\omega_f = \frac{\omega_i}{4}$.

Answer D.

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