

5.4 (b) Calculate the decrease in rotational kinetic energy.

Given: $I_i = 110 \text{ kg m}^2$, $\omega_i = 5.2 \text{ rad s}^{-1}$, $I_f = 230 \text{ kg m}^2$. Conservation of angular momentum ($L_i = L_f$): $I_i\omega_i = I_f\omega_f$.

$$\omega_f = \frac{I_i\omega_i}{I_f} = \frac{110 \times 5.2}{230} \approx 2.487 \text{ rad s}^{-1}$$

Initial rotational kinetic energy: $K_i = \frac{1}{2}I_i\omega_i^2 = \frac{1}{2}(110)(5.2)^2 = 1487.2 \text{ J}$. Final rotational kinetic energy: $K_f = \frac{1}{2}I_f\omega_f^2 = \frac{1}{2}(230)(2.487)^2 \approx 711.27 \text{ J}$. Decrease in energy:

$$\Delta K = K_i - K_f = 1487.2 - 711.27 = 775.93 \text{ J} \approx 776 \text{ J}$$