

Example 12



A potter's wheel is rotating around a vertical axis through its center at a frequency of 1.5 rev/s. The wheel can be considered a uniform disk of mass 5.0 kg and a diameter of 0.40 m. The potter then throws a 3.10 kg chunk of clay, approximately shaped also as a flattened disk of radius 8.00 cm onto the rotating wheel. What will be the frequency of the wheel after the clay sticks to it?

Wheel
 $m = 5.0 \text{ kg}$
 $r = 0.20 \text{ m}$

Clay
 $m = 3.10 \text{ kg}$
 $r = 0.08 \text{ m}$

$$L_o = L_f$$

$$I \cdot \omega_o = I \cdot \omega_f$$

$$\frac{1}{2}(5)(0.20)^2(1.5) = I \cdot \omega_f$$

$$0.942 = (I_{\text{wheel}} + I_{\text{clay}}) \omega_f$$

$$0.942 = \left(\frac{1}{2}(5)(0.20)^2 + \frac{1}{2}(3.10)(0.08)^2 \right) \cdot \omega_f$$

$$0.942 = 0.10992 \cdot \omega_f$$

$$\omega_f = 8.57 \text{ rad/s}$$

$$I = \frac{1}{2} m R^2$$

$$\frac{8.57 \text{ rad} / 1 \text{ rev}}{s / 2\pi \text{ rad}} = 1.36 \text{ rev/s}$$