

51. The turntable in Fig. 13-36 has rotational inertia $0.021 \text{ kg}\cdot\text{m}^2$, and is rotating at 0.29 rad/s about a frictionless vertical axis. A wad of clay is tossed onto the turntable and sticks 15 cm from the rotation axis. The clay impacts with horizontal velocity component 1.3 m/s , at right angles to the turntable's radius, and in a direction that opposes the rotation, as suggested in Fig. 13-37. After the clay lands, the turntable has slowed to 0.085 rad/s . Find the mass of the clay.

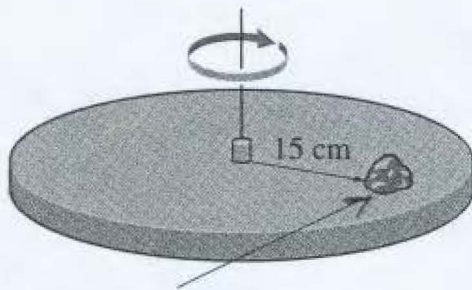
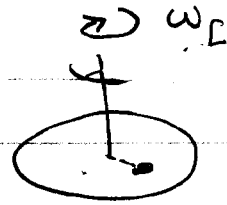
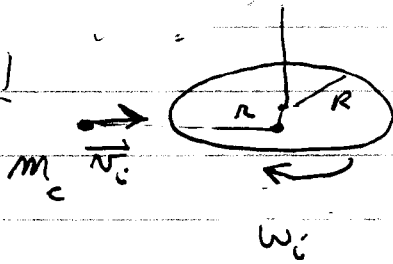


FIGURE 13-36 Problem 51.

13-5)



($\Sigma F = ma$? $\Sigma \tau = I\alpha$? $E_i = E_f$?)

$$L_i = L_f$$

$$-I_i \omega_i + m_c v_i r = -I_f \omega_f$$

$$= -[I_i + m_c r^2] \omega_f$$

$$I_i = 0.021 \text{ kg m}^2$$

$$\omega_i = 0.29 \text{ rad/s}$$

$$m_c = ?$$

$$r = 0.15 \text{ m}$$

$$v_i = 1.3 \text{ m/s}$$

$$\omega_f = 0.085$$

$$m_c v_i r + m_c r^2 \omega_f = I_i (\omega_i - \omega_f)$$

$$m_c = \frac{I_i (\omega_i - \omega_f)}{v_i r + r^2 \omega_f} = \frac{0.021 (0.29 - 0.085)}{[1.3 + (0.15)(0.085)] 0.15}$$

$$m_c = 0.0219 \text{ kg} = 21.9 \text{ g.}$$