34. ***REASONING*** The net torque $\Sigma\tau$ acting on the CD is given by Newton's second law for rotational motion (Equation 9.7) as $\Sigma\tau = I\alpha$, where I is the moment of inertia of the CD and α is its angular acceleration. The moment of inertia can be obtained directly from Table 9.1, and the angular acceleration can be found from its definition (Equation 8.4) as the change in the CD's angular velocity divided by the elapsed time.

SOLUTION The net torque is $\Sigma\tau = I\alpha$. Assuming that the CD is a solid disk, its moment of inertia can be found from Table 9.1 as $I = \frac{1}{2}MR^2$, where M and R are the mass and radius of the CD. Thus, the net torque is

$$\Sigma\tau = I\alpha = \left(\tfrac{1}{2}MR^2\right)\alpha$$

The angular acceleration is given by Equation 8.4 as $\alpha = \left(\omega - \omega_0\right)/t$, where ω and ω_0 are the final and initial angular velocities, respectively, and t is the elapsed time. Substituting this expression for α into Newton's second law yields

$$\Sigma\tau = \left(\tfrac{1}{2}MR^2\right)\alpha = \left(\tfrac{1}{2}MR^2\right)\left(\frac{\omega - \omega_0}{t}\right)$$

$$= \left[\tfrac{1}{2}\left(17 \times 10^{-3}\ \text{kg}\right)\left(6.0 \times 10^{-2}\ \text{m}\right)^2\right]\left(\frac{21\ \text{rad/s} - 0\ \text{rad/s}}{0.80\ \text{s}}\right) = \boxed{8.0 \times 10^{-4}\ \text{N}\cdot\text{m}}$$