Physics 200 Name: Key

Notes – 10.5 Angular Momentum and Its Conservation

1. Write the equation for linear momentum. $p = mv$

2. Write the equation for angular momentum. $L = I\omega$

3. State the Law of Conservation of Angular Momentum in words.

When net torque = 0, angular momentum remains constant

4. Write the equation for the Conservation of Momentum for.

$L_i = L_f$ $I_i \omega_i = I_f \omega_f$

6. Suppose an ice skater is spinning at 0.800 rev/ s with her arms extended. She has a moment of inertia of 2.34 $kg{\cdot}m^2$ with her arms extended and a moment of inertia equal to 0.363 $kg{\cdot}m^2$ with her arms close to her body. (These moments of inertia are based on reasonable assumptions about a 60.0-kg skater.)

A. What is her initial angular velocity, in rad/s?

$$\frac{0.8\ rev}{sec}\left(\frac{2\pi\ rad}{1\ rev}\right) = 5.03\ rad/s$$

B. What is her initial angular momentum?

$$L_i = I_i \omega_i = (2.34\ kgm^2)(5.03\ rad/s) = 11.8\ \frac{kgm^2}{s}$$

C. What is her final angular velocity?

$L_i = L_f$ $11.8\ kgm^2/s = (0.363\ kgm^2)(\omega_f)$

$L_i = I_f \omega_f$ $\omega_f = 32.4\ rad/s$

B. What is her rotational kinetic energy before and after she does this? Why does her KE_r change?

$$KE_{R\,Before} = \frac{1}{2}(2.34\ kgm^2)(5.03\ rad/s)^2 = 29.6\ J$$

$$KE_{R\,After} = \frac{1}{2}(0.363\ kgm^2)(32.4\ rad/s)^2 = 191\ J$$

KE increases because she does work as she pulls in her arms.