Physics 200 Name: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Notes – 10.5 Angular Momentum and Its Conservation

1. Write the equation for linear momentum.

2. Write the equation for angular momentum.

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

4. Write the equation for the Conservation of Momentum.

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⋅m2 with her arms extended and a moment of inertia equal to 0.363 kg⋅m2 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?

B. What is her initial angular momentum?

 C. What is her final angular velocity?

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

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**Practice – 10.5 Angular Momentum and Its Conservation**

1. A playground merry-go-round has a mass of 120 kg and a radius of 1.80 m and it is rotating with an angular velocity of 0.500 rev/s. What is its angular velocity after an initially motionless 22.0-kg child gets onto it by grabbing its outer edge? This might be easier to visualize if you picture the merry-go-round snagging the child and yanking him/her into motion. [You may assume that the merry-go-round is a uniform disc with I=1/2 mr2 and that the child is a point source with I=mr2.]

2. Ice Skater

A. Calculate the angular momentum of an ice skater spinning at 6.00 rev/s given his moment of inertia is 0.400 kg⋅m2.

B. He reduces his rate of spin (his angular velocity) by extending his arms and increasing his moment of inertia. Find the value of his moment of inertia if his angular velocity decreases to 1.25 rev/s.

C. Suppose instead he keeps his arms in and allows friction of the ice to slow him from 6.00 rev/s to 3.00 rev/s. What average torque was exerted if this takes 15.0 s?

3. What is the angular momentum of Earth rotating on its axis? MEarth = 5.97 x 1024 kg and REarth = 6371 km. Assume the Earth is a solid uniform sphere (I=2/5 mr2)

4. What is the angular momentum of the Moon in its orbit around Earth? The orbital radius of the Moon is 384,399 km, the Moon’s mass is 7.35 x 1022 kg and its orbital period is 27.321 days. A) What value should you use for *I* ? b) What is the angular momentum?

**Solutions**:

1. 2.30 rad/s

2. A. 15.1 kg m2/s B. 1.92 kg m2 C. -0.503 N m

3. 7.05 x 1033 kg m2/s

4. 2.89 x 1034 kg m2/s