Honors Physics – Angular Mechanics Practice Problems

1. In terms of volume, the largest tree is the General Sherman at Sequoia National Park in California. Assuming the tree is perfectly circular, its radius at the base is 5.55 m. If you were allowed to walk 31.3 m counterclockwise along the side of the tree, what would your angular displacement be?

2. Devil's Tower National Monument in northeastern Wyoming is an outcropping of volcanic rock that is 264 m tall. Suppose a golden eagle soars counterclockwise in a circular path around the top of the tower. If the eagle circles the monument once in 4.56 min, what is the bird's average angular speed in rad/s?

3. Jupiter has the shortest day of all of the solar system's planets. One rotation of Jupiter occurs in 9.83 h. If an average angular acceleration of -3.0×10^{-8} rad/s^2 slows Jupiter's rotation, how long does it take for Jupiter to stop rotating?

4. A model airplane is kept in a circular path by means of a control line. The airplane starts at rest and reaches an angular speed of 3.33 rad/s after a constant angular acceleration of 0.183 rad/s^2. How long does it take the airplane to reach its final angular speed?

5. A rotary saw with an angular speed of 298 rad/s cuts through a piece of wood. The saw undergoes a constant angular acceleration of –44.0 rad/s^2 while it goes through an angular displacement of 276 rad. What is the saw's final angular speed?

6. The drive wheel on a vacuum pump has an angular displacement of 158 rad as it accelerates from rest to 70.0 rad/s. What is the wheel's angular acceleration?

7. A professionally pitched baseball has an angular speed of 188.5 rad/s. The radius of a baseball is 3.73 cm. What is the tangential speed of a point on the baseball's surface?

8. An ice skater moves in a circle on a frozen pond. The skater has a tangential speed of 1.5 m/s and an angular speed of 0.33 rad/s. What is the radius of the circle in which the skater moves?

9. The old kinds of bicycles with the enormous front wheels and high seats are called *penny-farthings.* This is because the ratio of the big wheel's area to the small wheel's area is similar to the ratio of the areas of an old English penny to an old English farthing. The radius of the big wheel on a penny-farthing is 0.50 m. Suppose a rider accelerates from rest to a linear speed of 5.0 m/s in 8.5 s. What would the angular acceleration of the big wheel be?