

Rotational Inertia & Angular Momentum Conceptual Review

(Answer on a separate sheet of paper.)

1. When swinging your leg from your hip, why is the rotational inertia of the leg less than if it is bent?
2. How does rotational inertia affect how easily the rotational speed of an object changes?
3. Why do people with long legs generally walk with a slower stride than people with short legs?
4. The rotational inertia of an object is greater when most of the mass is located where? Explain.
5. A heavy iron cylinder and a light wooden cylinder, similar in shape, roll down an incline. Which will have more acceleration? Why?
6. Which will roll down an incline with greater acceleration, a hollow cylinder or a solid cylinder of the same mass and radius? Why?
7. Would you expect the rotational inertia of a hollow sphere about its center to be greater or less than the rotational inertia of a solid sphere? Defend your answer.
8. Why do buses and heavy trucks have large steering wheels?
9. Why are lightweight wheels used on racing bikes?
10. Can an object rotate if there is no torque acting on it? Defend your answer and illustrate it with an example.
11. Why does a child's toy top remain upright if it is spinning, but falls over as it slows down to a stop? Why does it slow down?
12. Explain the function of a long pole carried by a tightrope walker. Would it be more beneficial for the pole to droop downward at the ends, be perfect horizontal, or curve upward at the ends?
13. In which position would you expect the diver to perform a 2.5 somersault dive in a shorter time - in a tuck position or in a layout (open) position? Or does it matter? Why?
14. If you are in the center of a large turntable that rotates freely (no motor) at an amusement park and you crawl toward the outer rim, does the rate of the rotation increase, decrease, or stay the same? Which physics principle supports your answer?
15. If the polar ice caps melted, how would this affect the length of the day?