Physics 130: Questions to study for midterm #1 from Chapter 8

1. If the beaters on a mixer make 800 revolutions in 5 minutes, what is the average rotational speed of the beaters?
   a. 2.67 rev/min
   b. 16.8 rev/min
   c. 160 rev/min
   d. 4000 rev/min

2. What is the rotational speed of the second hand on a clock that measures the seconds?
   a. 0.000278 rad/s
   b. 0.00175 rad/s
   c. 0.0167 rad/s
   d. 0.105 rad/s

3. If a phonograph turntable takes 2 s to reach its rotational speed of 45 rpm, what is its average acceleration?
   a. 2 rpm/s
   b. 11.2 rpm/s
   c. 22.5 rpm/s
   d. 45 rpm/s

4. If it takes 3 s for a modern player to stop a DVD with a rotational speed of 7500 rpm, what is the magnitude of the DVD’s average rotational acceleration?
   a. 2500 rpm/s
   b. 22,500 rpm/s
   c. 150,000 rpm/s
   d. 1,350,000 rpm/s

5. A change in the rotational velocity of an object is produced by a net
   a. force.
   b. torque.
   c. rotational inertia.
   d. moment arm.

6. Newton's first law for rotational motion states that an object will maintain its state of rotational motion unless acted on by an unbalanced (or net)
   a. force.
   b. velocity.
   c. inertia.
   d. torque.
7. Newton's first and second laws for translational motion refer to the net force acting on an object. What is the rotational analog of this force?
   a. torque
   b. inertia
   c. acceleration
   d. force

8. What kind of motion does a constant, non-zero torque produce on an object mounted on an axle?
   a. constant rotational speed
   b. constant rotational acceleration
   c. increasing rotational acceleration
   d. decreasing rotational acceleration

9. If a ball with a weight of 30 N hangs from the end of a 1.5-m horizontal pole, what torque does the ball exert?
   a. 20 N·m
   b. 30 N·m
   c. 45 N·m
   d. 60 N·m

10. A pirate with a mass of 90 kg stands on the end of a plank that extends 2 m beyond the gunwale. What torque is needed to keep him from falling into the water?
    a. 45 N·m
    b. 180 N·m
    c. 450 N·m
    d. 1800 N·m

11. A meter stick is balanced on a stand. If you place a 50-g mass on one side at a distance of 20 cm from the center, how far from the center would you place a 25-g mass on the other side so that the system balances?
    a. 10 cm
    b. 20 cm
    c. 30 cm
    d. 40 cm

12. Two children with masses of 20 and 30 kg are sitting on a balanced seesaw. If the lighter child is sitting 3 m from the center, how far from the center is the heavier child sitting?
    a. 1 m
    b. 2 m
    c. 3 m
    d. 5 m
13. An object's resistance to a change in its rotational velocity is called its
   a. inertia.
   b. mass.
   c. torque.
   d. rotational inertia.

14. The rotational inertia of an object increases as the mass _____ and the distance of the mass from
    the center of rotation _____.
    a. increases ... increases
    b. increases ... decreases
    c. decreases ... increases
    d. decreases ... decreases

15. A solid disk and a hoop have the same mass and radius. Which has the larger rotational inertia
    about its center of mass?
    a. hoop
    b. disk
    c. They are the same.

16. Two flywheels have the same mass but one is much thinner than the other such that its radius
    is twice that of the smaller one. If both flywheels are spinning about their axes at the same
    rate, which one would be harder to stop?
    a. the one with the larger radius
    b. the one with the smaller radius
    c. They are equally hard to stop.

17. In which of the following positions would a diver have the smallest rotational inertia for
    performing a front somersault?
    a. tuck
    b. pike
    c. layout

18. When an Olympic caliber high-jumper executes the winning jump, we find that her center of
    mass
    a. must pass over the top of the bar by one-half the width of her body.
    b. must just clear the bar.
    c. passes below the bar.

19. A fully-loaded trailer truck is less stable than a race car because the truck
    a. is more massive.
    b. has a higher center of mass.
    c. has bigger wheels.
    d. weighs more.
20. If you stand with your back against a wall, you find that you cannot bend over to pick something up because your
   a. center of mass moves forward beyond your toes.
   b. vertical and horizontal motions are independent.
   c. center of mass is located at a fixed position in your body.
   d. center of mass hits the wall.

21. Under what conditions is the total angular momentum of a system conserved?
   a. It is always conserved.
   b. When there is no net outside force.
   c. When there is no net outside torque.
   d. When the kinetic energy is also conserved.

22. The reason a figure skater spins slower as he extends his arms is because
   a. he experiences a smaller torque.
   b. his angular momentum is greater.
   c. his angular momentum is less.
   d. his rotational inertia is greater.

23. It is possible for a high diver to execute more front somersaults in the tuck position than in the layout position because ______ in the tuck position.
   a. her angular momentum is greater
   b. her rotational inertia is less
   c. she exerts a greater torque
   d. her linear momentum is greater

24. A cat which is held upside down and dropped with no initial angular momentum manages to land on its feet. Where does the cat get the necessary angular momentum?
   a. from the air resistance
   b. from gravity
   c. from the torque
   d. It doesn't, none is needed.

25. A gyroscope which points directly up when it is located at the North Pole is transported to the equator while it is still spinning. Which way will it point?
   a. up
   b. down
   c. north
   d. south
26. Assume that Gerry sits on a freely rotating stool holding a bicycle wheel with its axle vertical so that it rotates in a clockwise direction when viewed from above. If Gerry turns the wheel over, he will
   a. not rotate because the system of wheel and Gerry is closed or isolated.
   b. not rotate because the two torques cancel.
   c. rotate clockwise because angular momentum is conserved.
   d. rotate counterclockwise because angular momentum is conserved.

27. A spinning top precesses because
   a. angular momentum is conserved.
   b. it experiences no net torque.
   c. it experiences no net force.
   d. gravity exerts a torque on it.