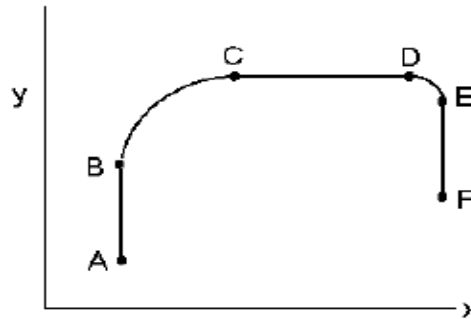**Name**_____

Unit 3 Conceptual Questions

Please answer questions on Scantron form 882-ES. Otherwise your will receive a zero. Poorly erased responses will not be re-graded. Turn in two days before unit exam. You are encouraged to work together and discuss these questions!!!

1. Your car moves in a circle at a CONSTANT speed of 50 m/s. The acceleration of your car is
   A. 50 m/s ^{2} B. zero   C. need more info to determine acceleration

2. If the speed of an object is constant, its acceleration must be zero. This statement is
   A. true   B. false

3. The net force vector on an object moving in a circle at a constant speed is directed
   A. away from the center of the circle
   B. toward the center of the circle

4. The figure below shows the path of a scooter on a flat horizontal surface. It starts at point A and moves at constant speed to point F. During which segment is the acceleration of the scooter greatest?
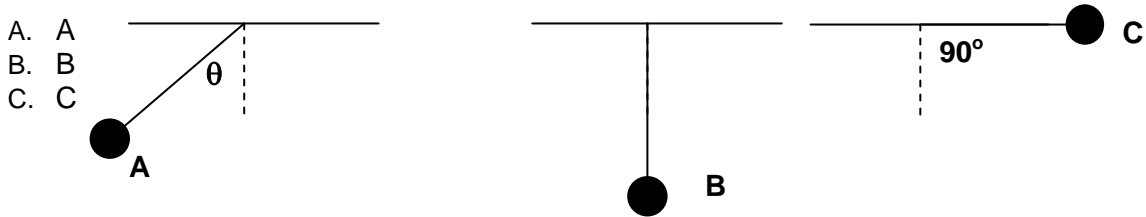   A. AB
   B. BC
   C. CD
   D. DE
   E. EF

5. In uniform circular motion there is no tangential acceleration. This statement is
   A. True   B. False

6. The radial component of an object undergoing circular motion has magnitude v^2/r whether or not speed is constant. This statement is
   A. True   B. False

7. A car is driven for one lap around a circular racetrack. Its speed around the track was not constant. The
   A. average speed of the car is the displacement divided by the time needed to complete the lap
   B. average velocity of the car is the total distance traveled divided by time needed to complete the lap
   C. average speed of the car is the total distance traveled divided by time needed to complete the lap
   D. average acceleration is zero
   E. average speed of the car is zero

8. If your car goes around a curve too quickly, you seem to be pushed against the door because of
   A. inertia
   B. centrifugal force
   C. friction
   D. centripetal force

9. Which of the following forces <u>must not be included</u> in a free-body diagram?
   A. centripetal
   B. friction
   C. gravity
   D. normal

10. A 100g mass is connected to a light string and suspended vertically. It is displaced through an angle greater than 90 degrees and released. The diagrams below indicate the position of the mass at different times t? In which position is the tension in the string greatest?

    A. A
    B. B
    C. C

    θ

    90°   C

    A

    B

11. A car goes over a bump in the road. The radius of curvature of the bump is R. Which of the following is true regarding the normal force acting on the car?
    A. The normal force acting on the car in independent of the speed of the car.
    B. The normal force acting on the car increases as the speed of the car increases.
    C. The normal force acting on the car decreases as the speed of the car increases.

12. As you round a level curve in your car, you suddenly hit some ice. On the ice, your car will
    A. veer toward the center of the curve.
    B. veer away from the center of the curve (in a direction that is opposite to choice A)
    C. continue in the direction it had when it hit the ice.

13. Suppose you are riding a roller coaster and you enter a circular vertical loop. Which of the following statements is true regarding your motion?
    A. The normal force and total energy are greatest at the top of the loop.
    B. Normal force is greatest at the bottom of the loop; total energy is greatest at the top of the loop.
    C. Normal force is greatest at the top of the loop; total energy is greatest at bottom.
    D. Normal force is same everywhere; total energy is greatest at bottom of the loop.
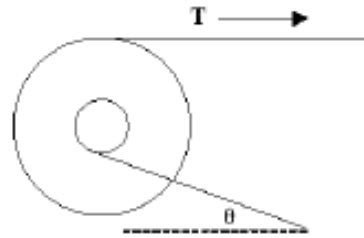   E. Normal force is greatest at the bottom of the loop; total energy is same everywhere.

14. A car rounds a level curve of radius R at constant speed. The coefficient of static and kinetic friction between the tires and the road are μ_s and μ_k, respectively. What is the maximum safe speed around this curve?

    A. $\sqrt{\mu_s gR}$ B. $\sqrt{\dfrac{gR}{\mu_s}}$ C. $\sqrt{\mu_k gR}$ D. $\sqrt{\dfrac{gR}{\mu_k}}$

    E. $\sqrt{\mu_s g}$

15. One can apply a force of 19N and 15N to counter the action of a single force of
    A. 3N   B. 14N   C. 35N   D. none of the above

16. When applying the condition for rotational equilibrium on a body, one sums the torques about an axis
    A. passing through the center of mass of the body.
    B. passing through any point on the body.
    C. passing through the geometrical center of the body.
    D. passing through the line of action of the forces.
    E. none of these.

17. A wheel of outer radius R has an axle of radius R/4. Strings are wrapped as shown around the rim of the wheel and around the axle. If the string around the rim of the wheel has tension T, then in order to keep the wheel from turning the tension in the string around the axle must be:
    A. 4Tsinθ
    B. 4T
    C. T/4
    D. (T/4)sinθ

18. Consider the following statement: The center of gravity is always at the geometric center of an object. This statement is
    A. True   B. False

19. Consider the following statement: An object is in equilibrium only if the sum of the forces acting on it is zero. This statement is
    A. True   B. False

20. The name of the quantity which is greater for a long 100 pound barbell than for a short 100 pound barbell, and makes the long barbell harder to twist is rotational
    A. momentum   B. energy   C. inertia   D. weight

21. Why can't you open a door by pushing on its hinged side?
    A. The lever arm is zero
    B. the torque is zero
    C. both a and b are correct
    D. none of the above

22. Moment of inertia describes
    A. The average position of the mass in an extended object.
    B. How the mass of an extended object is distributed about a rotation axis.
    C. How a force can rotate an object.
    D. The tendency of an object to move in a straight line.

23. A student sits in a spinning stool with her arms folded. When she extends her arms away from her body, her angular momentum
    A. increases
    B. decreases
    C. remains the same

24. Five forces of the same magnitude act on a square that can rotate about point P at the midpoint of one of the edges. The edge is of length L. What is the lever arm for F_5 in terms of L?
    A. 0
    B. L/2
    C. L/2sin 30°
    D. L/2sin 60°
    E. L

25. What is the lever arm for F_1 in terms of L?
    A. 0
    B. L/2
    C. L/2sin 30°
    D. L/2sin 60°
    E. L
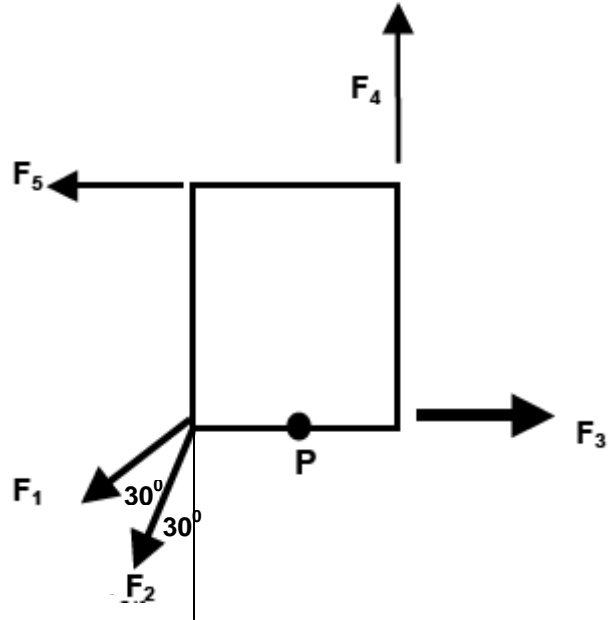
26. What is the lever arm for F_3 in terms of L?
    A. 0
    B. L/2
    C. L/2sin 30°
    D. L/2sin 60°
    E. L

27. Rank the forces (in ascending order) acting on it according to the magnitude of the torque they create about point P
    A. F2, F3, F4,&F5 (tie), F1
    B. F3, F4, F1, F2, F5
    C. F5, F4, F3, F1, F2
    D. F3, F1, F2, F4, F5
    E. F4, F3, F2, F5, F1

28. Angular velocity and linear velocity have the same dimensions. This statement is
    A. True
    B. False

29. A solid sphere and a hollow sphere roll down an incline. The hollow sphere is slower than the solid sphere if
    A. mass of the hollow sphere equals the mass of the solid sphere
    B. radius of the hollow sphere equals the radius of the solid sphere
    C. both masses and radii are equal
    D. the hollow sphere is always slower regardless of their masses and radii.

30. Suppose the objects in the problem above have the same mass and radius. Which object has more kinetic energy when it reaches the bottom of the incline?
    A. The solid sphere
    B. The hollow sphere
    C. They both have the same kinetic energy
    D. More information is needed.

31. Suppose a solid sphere and a hoop are rolled up an incline plane with the same initial velocity. Which object will travel furthest up the plane?
    A. The solid sphere
    B. The hoop
    C. The maximum heights will be the same since their initial velocities are the same!

32. The upward buoyancy force on a 20 ton floating ship is
    A. 20 tons   B. less than 20 tons   C. more than 20 tons
    D. need to know shape of ship

33. A boat carrying a large boulder is floating on a lake. The boulder is thrown overboard and sinks. The water level in the lake (with respect to the shore)
    A. rises.   B. sinks.   C. remains the same.

34. Two objects of the same volume are placed in water. Object A floats and Object B sinks. The greater buoyant force is on
    A. object A   B. object B   C. both are same

35. Two objects of the same mass are placed in water. Object A floats and Object B sinks. The greater buoyant force is on
    A. object A   B. object B   C. both are same

36. If gauge pressure is tripled, the absolute pressure will
    A. not change
    B. be reduced by a factor of 3
    C. triple
    D. not enough information is given to determine what happens.

37. In a hydraulic arrangement with two pistons, the small piston has a radius of 5.00 cm, and the large piston has a radius of 20.0 cm. A force of 256 N on the large piston would lift a weight of _____ Newtons on the small piston.
    A. 4N   B. 16N   C. 32N   D. 64N   E. 128N

38. You wear snowshoes in the snow because snowshoes help reduce the _____against the snow.
    A. force   B. pressure   C. mass

39. A 50g piece of copper and 50g piece of aluminum rest at the bottom of a container filled with water. The buoyant force is greater on
    A. the lead object   B. the aluminum object   C. the same on both

40. You place a water pump on a cliff 25m above a lake. You run a long pipe from the pump into the lake. The goal is to pump some water for your use. Which of the following is true about your system?
    A. This will always work; the size and suction power of the pump won't matter.
    B. This will work if the pump's suction is sufficient.
    C. This will never work.